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THE ROLE OF INNOVATION IN ORGANIZATIONAL DEVELOPMENT

Robert H. Davis
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LEADERSHIP AND MANAGEMENT TECHNICAL AREA



U. S. Army
Research Institute for the Behavioral and Social Sciences

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20. will make organizations more effective or efficient. The aim of article is to show how by focusing on innovation (technical/structural/and physical changes), organizational development can contribute to both individual growth and increased effectiveness.)

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THE ROLE OF INNOVATION IN ORGANIZATIONAL DEVELOPMENT

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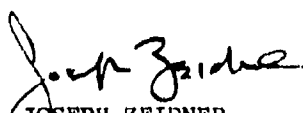
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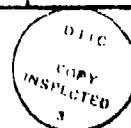
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FOREWORD

The Leadership and Management Technical Area of the Army Research Institute for the Behavioral and Social Sciences (ARI) is conducting research on the Army's Organizational Effectiveness (OE) Program. OE involves the use of selected management and behavioral science skills and techniques to improve the effectiveness of Army organizations. In the civilian community, this approach is known as organizational development, or OD. Both OE and OD are concerned with organizational change and innovation. Dr. Robert H. Davis, of Michigan State University, has been working for many years in the area of organizational innovations. In this paper, he reviews the innovation and organizational development literature, integrates those findings, and identifies approaches which lead to the implementation of technical innovations. This research was conducted while Dr. Davis was on sabbatical at the Army Research Institute under Army Project 2Q263731A792, "Command Processes and Evaluation," FY79 and FY80 Work Program.


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THE ROLE OF INNOVATION IN ORGANIZATIONAL DEVELOPMENT

BRIEF

Requirement:

Theory and practice in the area of organizational development have emphasized the role of social and psychological factors in the improvement of organizational effectiveness rather than technical/structural/physical changes. Although numerous investigators have commented on the importance of optimizing both the social and technical side of organizations, in practice organizational change agents have generally concentrated on the human side of organizations, in part at least because very few intervention strategies stress operational innovations.

Procedure:

The innovation and organizational development literature was reviewed in an effort to integrate some of the findings from that literature and identify approaches to organizational change that would facilitate the discovery, adoption, and implementation of technical innovations.

Findings:

A critique of the literature reveals that the most frequently cited instances of successful organizational change often involve technical and structural innovations that tend to be overlooked or ignored by their authors who often explain their results in terms of human factors. The role of organizational development is here defined as creating an organizational climate for problem solving that stimulates the discovery of innovations. Working within a problem solving framework, the basic strategy described is one of identifying variances and searching for innovative solutions to them. Four approaches to the identification of variances are examined. Numerous obstacles to constructive problem solving in organizations can be identified, including the fact that groups value unanimity and discourage exceptions, the tendency of some people to dominate the search process, inappropriate leader behaviors, and the tendency of groups to move to solutions before defining problems fully.

Utilization of Findings:

This report will be of most value to those involved in programs for improving organizational effectiveness, either as change agents or managers. The specific objective is to provide such individuals with a broad theoretical framework for understanding the improvement of performance in organizations and to encourage organizations to more fully utilize the creative abilities of their members to suggest changes of a technical/structural/physical nature that will have an impact on a unit's effectiveness. The report contains an annotated bibliography of literature cited which should also be of substantial value as a guide to others conducting research on organizational change.

THE ROLE OF INNOVATION IN ORGANIZATIONAL DEVELOPMENT

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PREFACE

Some of the staff members of the Army Research Institute for the Behavioral and Social Sciences (ARI), where I am on sabbatical leave from Michigan State University, suggested that this document would be useful to officers in the armed forces and others who have a special interest in the problem of improving organizational effectiveness using methods of organizational development.

What follows is a chapter from a larger work that is now in progress entitled Organizational Innovation and Renewal. A few preliminary remarks about the theme of that book and one or two definitions may help to clarify the ideas developed in this chapter.

Organizational renewal may be seen as a dynamic process of adaptation in which organizations continuously evaluate their inner and outer environments against shifting criteria and devise new programs. The main line of argument which I have put forward in Organizational Innovation and Renewal is this: the major objective of organizational renewal is to improve organizational effectiveness, and the best way to achieve this objective is by creating a climate that fully utilizes the creative abilities of human beings to innovate and contribute to organizational change.

Organizational renewal is seen as a search process in which invention and innovation are major outcomes. To invent is to create or devise something new for the first time. Invention always involves the origination of an idea. By comparison with innovations, inventions are relatively rare because they must pass what has sometimes been called "the cultural test of novelty," which means that an invention must be genuinely new to all cultures and not merely new to some individual or organization.

Innovations need not pass the cultural test. The conditions that govern the cultural test are embodied in patent law and involve concrete facts and hard evidence. In contrast, innovations are matters of human perception and judgment which are less objective. If something is perceived as new, either by an organization or by an individual, it is an innovation.

Innovation, therefore, involves some sort of rearrangement of the world that is new for some individual or organization. Inventions make such rearrangements possible, but innovations may stem from many other kinds of discoveries as well as from inventions, discoveries about the skills of people in organizations, for example, or the needs of the marketplace, or ways of circumventing restrictions imposed by regulations, etc.

Thus far, I have described innovation as something that is new. But the term innovation is, also, used to describe a dynamic process. As a process, innovation involves the actual discovery, adoption, and

utilization of things, such as programs, techniques, products, and inventions, that are new to an individual or organization.

Much of the literature on innovations has been concerned with change from the perspective of individuals. But we are here concerned with innovations of organizations, which is a somewhat different process. The fact that some individual or individuals in an organization, even its leaders, decide to adopt an innovation, does not guarantee that the organization will accept or use it.

My basic objective in this chapter is to describe the important part played by innovation in the area known within the military as organizational effectiveness, but more generally called organizational development, or sometimes just organization development. Dr. T. Owen Jacobs encouraged me to work on this problem during my tenure in the group which he heads at ARI, and I am indebted to him, not only for his support, but for many valuable suggestions as well. Dr. Laurel W. Oliver and Dr. Francis E. O'Mara made substantial contributions to my thinking about organizational effectiveness, but it goes without saying, they bear no responsibility for my misperceptions or my intellectual innovations.

August 1, 1980

Dr. Robert H. Davis
Alexandria, Virginia

THE ROLE OF INNOVATION IN ORGANIZATIONAL DEVELOPMENT

INTRODUCTION

The ultimate goal of organizational renewal is the improvement of organizational effectiveness. I will argue in this document that improved organizational performance and effectiveness is contingent on the use of techniques that promote the discovery and use of innovations. Some organizational development (OD) methods encourage innovation some of the time; but the link between most organizational development techniques and improved organizational performance is tenuous at best.

The underlying values that guide organizational development activities are humanistic and often invite change agents to concentrate their energies on increasing personal growth and making the individual's life more meaningful and satisfying, rather than on technological changes. Unfortunately, there is little reason to believe that greater satisfaction in the typical organization will in and of itself improve organizational effectiveness or efficiency. Unless one of the major outcomes of organizational development is innovation, then an organization's overall effectiveness is not apt to improve very much. After all, there is a limit to how fast people can work and the energy they can expend without physical impairment.

What most efforts at organizational development do is to set the stage for creative problem solving that makes greatly improved productivity possible. In other words, organizational development helps to establish conditions that increase the likelihood that an organization will discover, adopt, and use innovations that will lead to substantial improvements in their performance; but for this to occur, the situation must be structured to encourage innovation, as it is for example in the Scanlon Plan (Frost et al., 1974).

One might reasonably argue that the most meaningful and enduring path to personal satisfaction and "self-actualization" is through creative participation in the innovation process and the social and personal benefits that result from increased productivity. The aim of this chapter is to show how, by focusing on innovation, organizational development activities can contribute to both individual growth and organizational renewal.

Humans design the organizations in which they participate. Their involvement as architects of, and participants in, organizations has both advantages and disadvantages. The major advantage is that their special knowledge and creative talents can be tapped to redesign organizations and make them more effective. But as we have already noted a number of times, the requirements for control and reliability of individual

performance that bureaucracies impose on organizations may cause people in them to engage in disruptive, rather than constructive, behaviors. As a result, behavior in bureaucracies may interfere with problem solving and the implementation and evaluation of potentially effective innovations.

Appropriately used, organizational development can help to overcome some of the consequences of bureaucratization and stimulate more constructive behaviors by:

1. Eliminating or reducing the impact of system dysfunctional actions through conflict resolutions, role clarification, definition of common objectives, etc.
2. Creating a climate for change--a climate of openness and trust that encourages suggestions and the free exchange of information.
3. Stimulating problem solving and creating involvement in the processes by which innovations are discovered and implemented.
4. Increasing the motivation of the organization's members to become more involved with and committed to its objectives.

These four outcomes may be thought of as the primary goals of organizational development.

WHAT IS ORGANIZATIONAL DEVELOPMENT?

Long before the term organizational development was invented, organizations engaged in planned change. Most organizations today, whether they apply the techniques of organizational development or not, are interested in improving their performance by the systematic application of a wide variety of sometimes highly effective techniques that guide planned change from operations research to zero-based budgeting. Although these techniques are used to develop and improve organizations, they are not normally considered to be methods of organizational development. As a matter of fact, the term organizational development has been co-opted by behavioral scientists who have assigned a rather restricted definition to it and distinguished Organizational Development, with a capital OD, from other forms of planned change. My purpose in this section is to examine some of the definitions of organizational development that have been suggested and propose a new one that recognizes the central role of innovation.

Organizational Development: Philosophy, Assumptions, and Techniques

Organizational development is both a philosophy of organizational change and a set of strategies and techniques for implementing that philosophy.

The Philosophy and Assumptions of OD. As a philosophy, organizational development is based on the behavioral sciences and is rooted in certain basic assumptions about men and women. We will consider first what it means to be science-based and then develop one or two of the assumptions that support OD.

Whitehead (1925) pointed out over 50 years ago that science flourished first in the West because of the Christian faith that an omniscient God had created a lawful world, a world in which He knew when and where every sparrow fell. Western science is based on the faith that there are universal laws to be discovered if one only uses the appropriate methods. Behavioral scientists have extended this assumption to humans, and they have used both the empirical and analytic methods of science to enrich our understanding of human behavior. This scientific knowledge about behavior provides the foundation and justification for the principles and practices of OD.

Science, also, includes a variety of canons for evaluating the validity of knowledge. At its best, organizational development seeks to confirm or disconfirm its principles and practices by subjecting them to systematic observation and controlled experimentation.

Numerous writers have identified the basic assumptions about individuals and groups that undergird organizational development activities (see, for example, French, 1969; McGregor, 1960; and Huse, 1975). Two of the most widely held assumptions bear directly on the issue of innovation in organizations.

First, organizational development assumes that most people (in the Western world at least) have powerful needs for personal growth and development. These needs provide the basis for motivation in, and commitment to, organizations. One way to harness this motivation is to invite people to participate in the redesign of the organizations of which they are a part. When workers are given an opportunity to invent their own future, to develop what Miller (1979) calls "Utopian fantasies," the entire organization can be moved to a new level of productivity. But for a variety of reasons, many organizations do not try to satisfy these needs and may even frustrate them. As a consequence, productivity and quality suffer.

Second, organizational development assumes that people are creative and capable of contributing far more to organizations than is generally realized. A number of years ago, I participated in the development of a major organizational development activity for the Air Force. Engineers and physical scientists who were responsible for the project developed a number of models of the system on which they were working. Not knowing how to factor in the human component, they called on some psychologists to help them determine how much humans degraded the system. The psychologists said that it was nonsense to assume that humans invariably degraded any system by some fixed percentage, and they proceeded to set up a series of experiments which demonstrated that when properly used, humans

could improve the performance of a system over its initial design specifications (Chapman et al., 1959). The essential point is that humans have great creative potential for innovation and invention. The problem is to harness it, to find ways of dipping into the pool of knowledge that lies waiting to be tapped, and exploiting that knowledge.

Strategies of OD. Organizational development uses two somewhat different strategies to achieve its objectives. The first of these is basically an educational strategy that stresses change in personal beliefs, attitudes, and values in an effort to create an organizational climate for change. The second is a problem solving strategy. The difference between these two approaches is illustrated by citing two definitions of organizational development.

The first definition is by Warren Bennis (1969) and stresses education and organizational climate.

Organizational development (OD) is a response to change, a complex educational strategy intended to change the beliefs, attitudes, values, and structure of organizations so that they can better adapt to new technologies, markets and challenges, and the dizzying rate of change itself. (p. 2)

The second definition, by French and Bell (1975), emphasizes problem solving, action research, and climate (culture).

Organization development is a long-range effort to improve an organization's problem-solving and renewal processes, particularly through a more effective and collaborative management of organization culture--with special emphasis on the culture of formal work teams--with the assistance of a change agent, or catalyst, and the use of the theory and technology of applied behavioral science, including action research. (p. 14)

From the perspective developed in this book, organizational development incorporates both of these ideas. Organizational development is (1) a behavioral-science based, educational strategy for cultivating organizational climates that facilitate planned change; and (2) a problem solving, action research strategy that encourages the constructive involvement of people in the redesign of the organizations of which they are a part through the creation, tailoring, and implementation of innovations.

Three Preliminary Distinctions

Before describing the educational-culture and problem solving components of organizational development in greater detail, there are three important preliminary points that must be made. They concern the distinction between primary and secondary innovations, the focus on organizational performance rather than individual performance, and the importance of technical/structural/physical changes in OD.

Primary Versus Secondary Innovations. Virtually all organizational development involves innovation at the primary and possibly the secondary level. By primary level, I mean that organizational development interventions themselves are innovations for most organizations. Such interventions as autonomous work groups, job restructuring, and participative decision making are examples of primary innovations. Innovations of this kind are often "discovered" and implemented with the aid of a change agent who has had special experience with them in other settings. But, in many instances these interventions are merely vehicles for discovering secondary innovations. Secondary innovations result from OD interventions that tap the creative, problem solving talents of employees. By permitting employees to have a greater voice in the operations for which they are responsible (a primary innovation), for example, they are more apt to discover secondary operational innovations that will improve effectiveness.

Individual Versus Organizational Performance. In any discussion of organizational renewal, it is essential to carefully distinguish between individual and system performance. In most organizations, any given individual makes only a relatively small contribution to the final output of the organization. Although there may be a relatively high correlation between the performance of some individuals and organizational performance, this is not necessarily true of all individuals nor even of most individuals in many organizations. People within an organization frequently compensate for the low motivation, low productivity, carelessness, etc., of others. Furthermore, organizations intentionally structure themselves to adjust for weaknesses of this kind through load sharing, redundancy, load allocation, automation, etc.

Much of the research on the impact of organizational climate, job satisfaction, morale, and motivation on productivity is focused on the performance of individuals, not organizations. The extensive body of research on the relationship between employee satisfaction and performance, for example, deals almost exclusively with individual, rather than system, performance. (For examples see Herzberg, 1966; and Brayfield and Crockett, 1955.)

Our focus in this document is on the adoption and implementation of organizational innovations which, by definition, are intended to improve organizational performance. As I have already suggested, organizational development contributes to organizational performance by creating a culture or climate in which problem solving and innovation are encouraged. Although OD efforts sometimes concentrate on human factors alone, by the use of sensitivity or laboratory training, for example, there is no evidence that these methods by themselves improve organizational performance (Campbell and Dunnette, 1968; Bowers, 1973). Such methods are often used to "unfreeze" organizations (see, for example, Blake and Mouton, 1964, 1966, 1971) and pave the way for more substantive innovations, but change agents must constantly guard against the common fallacy of assuming that by enhancing job satisfaction through various "soft" techniques, organizational

performance can be improved. There is no established direct link between individual satisfaction and individual performance in an organizational setting (see, for example, Greene, 1972), to say nothing about a link between individual satisfaction and organizational performance.

The major danger of concentrating change efforts exclusively on personal development is that the technical/structural/physical side of organizations, which is the channel for organizational innovation and renewal, will be neglected. As sociotechnical theorists have reminded us for the past three or four decades, the two sides must be jointly optimized.

Technical/Structural/and Physical Changes. One final point that should be made before we discuss the two major strategies of OD concerns the pervasiveness of technical/structural/and physical innovations in successful instances of organizational development. In most successful examples of OD, primary and secondary innovations almost invariably involve technical, physical, or structural changes that are either introduced by change agents or discovered by the organization's members. This should be obvious for primary innovations such as autonomous work groups, job restructuring, and other examples of sociotechnical interventions. Similarly, the Scanlon Plan, which is a primary innovation, always involves, as an integral part of its design, secondary innovations in the form of employee-generated suggestions.

But even in the case of participative decision making, where successful outcomes are often attributed to psychological factors, such as increased motivation or satisfaction, secondary innovations of a technical nature are frequently involved. In the now classic studies of Coch and French (1948), for example, in which employees who were encouraged to discuss their new jobs were more productive than those who were introduced in the traditional way, secondary innovations and problem solving apparently played a crucial role in the outcome (Gardner, 1977). Experimental groups were given the opportunity to examine and problem solve about competitive garments which were denied to the control group, and a number of "frills" were eliminated from the garments that they were producing. These suggestions probably account in part at least for the increased productivity noted in the study.

Continuous problem solving was apparently not a feature of the Coch and French studies, but there are other examples of participative decision making in the literature that clearly involve as the primary outcome of participation the repeated collection and analysis of suggestions for technical/structural/physical changes. In one highly successful study of participative decision making by Bragg and Andrews (1973), for example, the productivity of a hospital that encouraged participative decision making (PDM) was compared with two hospitals that did not offer this opportunity to employees. By comparison with the control hospitals, attitudes improved, absences declined, and productivity increased in the experimental hospital. The mechanism for involvement of employees was a

series of meetings where they were encouraged to make suggestions and decide whether or not to implement them. Of 147 suggestions made in the course of the study, 90 involved changes in work flow and 44 involved equipment modifications. Many of these changes were undoubtedly completely new for the experimental laundry, i.e., they were secondary innovations. Commenting on the importance of involving employees in problem solving about the organization, the authors make the following observation:

Looking back at the foreman's record of PDM meetings, it can be seen that 90 percent of all employee suggestions involved technological modifications in the laundry subsystem....We believe that releasing this rich vein of heretofore untapped energy led to technological and attitudinal changes that substantially increase productivity.

Problem solving and innovation were also important ingredients in the participative decision making study by Bartlett (1967), which he reported as an attempt to shift a manufacturing organization from Theory X to Theory Y. Focusing on behavior rather than attitude change, Bartlett designed a communications laboratory to "unfreeze" participants and increase their problem solving behavior. Explaining how the laboratory facilitated improvements in productivity, the author notes that "The problem was not defined as being whether Epsilon's managers could (or wanted to) solve its problems. Rather, it was how best to remove the cultural restraints preventing them from making their own greatest contribution... the simple explanation as to why the changes took place at Epsilon is this...the supervisors already had sufficient ideas to vastly improve production...." The problem was to establish "a climate in which Ss could realize their desire to communicate their ideas for improvement..." (p. 401).

In their review of 78 work-improvement studies, Cummings and Molloy (1977) described a wide range of factors that organizational development change agents manipulate to produce positive change, including: (1) pay/reward systems; (2) autonomy/discretion; (3) improved support services; (4) training; (5) organizational structure; (6) technical/physical changes; (7) task/variety; (8) information/feedback; and (9) patterns of interaction among people. All of these are potentially primary innovations, of course. But secondary innovations, particularly secondary technical/structural/physical innovations, are a significant feature of many of the experiments analyzed by Cummings and Molloy. As a matter of fact, the authors comment on the pervasiveness of technical/physical changes. But they may still underestimate the role of technical/physical changes because they frequently overlook secondary modifications in the work setting that result from focal primary innovations, such as participative decision making. Thus, when itemizing the "action levers" used in the French and Coch study and in the experiment by Bragg and Andrews, which we have just described, Cummings and Molloy do not cite physical/technical factors as contributing to the final outcome, but as I have

just noted, technical/physical factors played an important part in the outcome of these studies.

Even studies, which use operant conditioning as the primary innovation, may involve secondary technical innovations that contribute to improvements in productivity. At Emery Air Freight, for example, an extensive program of positive reinforcement was introduced in an effort to increase productivity (Organizational Dynamics, 1976). A careful reading of the article that describes this work suggests that innovation played a major role in the improvement noted and that positive reinforcement was used primarily to motivate employees to use that innovation. The author points with satisfaction to a savings of \$650,000 made possible by the simple innovation of combining small shipments into a single container. Operant conditioning helped to motivate employees to follow the procedure which resulted in these savings. Furthermore, there are a number of comments, such as the following, that suggest employees were encouraged to problem solve: "Even with the below par employees, the manager takes a positive note...." (Here the manager follows the practice of waiting for a slight improvement in performance.) "Then he might follow up his praise of the improvement by asking the man what he (the employee) thought could be done to improve further. Everything he did from there on would be an attempt to solve the problem and provide the manager with additional opportunities for reinforcement.... The biggest problem with the program occurs when the manager (italics mine) stops asking for feedback...." (p. 44).

ORGANIZATIONAL CLIMATE AND OD

Most definitions of organizational development suggest that one of the major objectives of OD is the creation of a climate that encourages planned change. What precisely do we mean by organizational climate? And what are the features of an organizational climate that are conducive to innovation?

Properties of Organizational Climates

A wide range of environmental factors influence the motivation and behavior of people in organizational settings from styles of leadership to incentive structure. Efforts to define climate have been directed primarily at isolating a small but comprehensive set of properties that can be used to characterize the climates of different organizations. These properties are commonly based on the perceptions of people about the organizations in which they work.

There is no general agreement about what factors are necessary or sufficient for describing the climate of different organizations. Litwin and Stringer (1966, 1968), who define climate in terms of environmental and perceptual factors that affect behavior, developed a questionnaire

for measuring perceptions in six different areas: (1) Organizational Structure, which is a measure of bureaucratization; (2) Individual Responsibility; (3) Adequacy and Appropriateness of Rewards; (4) Degree of Challenge and Risk; (5) Warmth and Support; and (6) Tolerance and Conflict.

Campbell et al. (1970) summarize the work of Litwin and Stringer and a number of other writers in this area, and they found some commonality among the various authors reviewed and suggested a synthesis that includes the following four factors:

1. Individual autonomy. The keystone of this dimension is the freedom of the individual to be his own boss and reserve considerable decision making power for himself. He does not have to be constantly accountable to management.
2. The degree of structure imposed upon the positions. The principal element is the degree to which the objectives of, and methods for, the job are established and communicated to the individual by superiors.
3. Reward orientation. The factors (from various other writers on the topic, including general satisfaction, reward, promotion-achievement orientation) do not hang together quite as well as the previous two factors.
4. Consideration, warmth, and support.

In addition to these four factors, Campbell and his colleagues were tempted to add a fifth group incorporating ideas such as "presence of conflict," "tolerance of conflict," and "working with cooperative and pleasant people," but they did not do so explicitly.

Climate, Effectiveness, and Innovation

The studies described thus far merely identify properties that may be useful for characterizing organizational climate. They do not attempt to relate organizational climate to organizational effectiveness. Numerous studies, going back at least to the work of Lewin, Lippitt, and White (1939), bear directly on this issue.

The studies of Lewin and his associates concentrated primarily on the interpersonal effects of changes in leadership style. However, other studies have tried to measure the impact of leadership on organizational effectiveness more directly.

One of the earliest and best known experiments of this kind was reported by Morse and Reimer (1956). Working with the top management of a nonunionized industrial organization, Morse and Reimer identified four

divisions of a department that were matched for productivity. They then conducted a controlled experiment in which two of these divisions were given greater control and discretion over all aspects of the work situation (autonomy); and two divisions were subjected to tighter controls (hierarchical). Measures of satisfaction and productivity were taken after one year.

Attitudes of employees in the divisions that were given greater autonomy improved significantly in a number of areas over the course of the study, whereas attitude deteriorated in divisions experiencing hierarchical control. Improvements in attitudes were noted particularly in the autonomous divisions toward supervision, the program, and the company. Overall job satisfaction decreased in the hierarchical divisions but remained unchanged in the autonomous divisions. Productivity increased significantly in both groups, but the increase was greater in the divisions that were hierarchically controlled than in those that were autonomous.

Efforts to explain the fact that hierarchical divisions had better productivity than autonomous divisions have generally focused on the fact that workers who were not needed could be transferred to other divisions (thereby increasing productivity), and members of autonomous work groups may have been more reluctant to transfer such workers than supervisors of the hierarchical divisions. If one pursues the analysis suggested in this document, however, there is no reason to expect increases in productivity merely because workers are given greater autonomy. Rather, one must ask: How is the autonomy used? Is the autonomy used to encourage workers to problem solve about their jobs and implement innovations? Or is it adopted in the expectation that it will more or less automatically improve productivity?

A study by Litwin and Stringer reported in Campbell et al. (1970) bears directly on the effect on productivity of encouraging innovation. In their study, Litwin and Stringer assigned 45 students from the Harvard Business School to work in three simulated firms that were in competition for a contract award. The president of these three simulated firms were members of the research team. They adopted quite different leadership styles, creating three unique organizational climates: (1) an authoritarian structured climate; (2) a democratic climate; and (3) an achieving climate. The achieving climate, in which innovation was encouraged, was most productive in terms of dollar volume, number of new products, and cost-saving innovations. Product quality, however, was highest in the authoritarian-structured firm. Players who worked in the democratic climate were more satisfied with their jobs than players in the other two firms.

How Climate Contributes to Innovation

We have noted that one of the major purposes of organizational development is the creation of a climate that encourages innovation and

change. From the work of Campbell and his colleagues, it might be expected that the four factors, which they identified, would set the stage for innovation. But, if these four factors are indeed important ingredients in the change process, how do they work? How, for example, does greater autonomy contribute to innovation and productivity? In an effort to answer this question, let us examine each of the four factors that make up climate in somewhat greater detail and relate them to innovation.

Factor #1: Individual Autonomy. By individual autonomy, Campbell et al. mean that workers have the power within their sphere of influence to make their own decisions. The essential notion here is the freedom to make changes that will not adversely affect productivity and may improve it. This freedom inevitably carries with it certain risks that management must be willing to accept. When people are free to make their own choices, there is a good chance that they will make the wrong ones from management's point of view at least some of the time.

Autonomy, creativity, and tolerance would appear to be closely related dimensions of organizational climate. An organization which encourages its employees to be autonomous must be willing to accept the creative ideas that will spontaneously emerge and tolerate the differences among individuals that will become apparent. Siegel and Krammerer (1978), who have developed a scale for measuring the perceived support for innovations in organizations, found that acceptance of creativity and tolerance of differences are key features of the climate of innovative organizations.

Based on a factor analysis of their scale, they concluded that it measured three unique factors: (1) support for creativity; (2) tolerance of differences; and (3) personal commitment. The scale was administered to 1,899 students and faculty in public schools judged to be innovative and traditional. Two factors seemed to differentiate between the schools that were innovative and those that were not: schools in which creativity was supported and individual differences were tolerated were more likely to be innovative. Autonomy encourages innovation by freeing individuals to think creatively about their jobs and propose innovations without fear that they will be criticized for being different.

There is a second way in which autonomy may contribute to innovation and increased productivity. Autonomy permits variances to be controlled at their source, which is one of the central principles of sociotechnical design (Cherns, 1976). Power to take action is vested in individuals who are nearest to the problem and most apt to recognize it early, and in individuals who are likely to understand the problem well enough to propose successful and creative solutions to it.

Factor #2: Structure. Structure here refers to the extent to which objectives and methods are clearly defined. The data at hand permit us to do little more than speculate about how structure might influence innovation and renewal.

There is a rather widespread conviction today among many groups of people that clearly defined objectives are important for many different types of activities. Operationally defined objectives are assumed to contribute to organizational effectiveness by focusing the attention of individuals on common goals that are understood by all and by reducing the ambiguity that often surrounds the goals that guide policy formation and action in organizations. While there is no evidence to my knowledge on this issue with respect to innovation, it is generally recognized that in all problem solving, an important preliminary step to it is to clearly and operationally define the problem. Well-stated objectives facilitate problem definition and, therefore, may contribute to innovation.

On the other hand, over-structuring work methods may interfere with innovation. Once again, there is no direct evidence on this question which I am aware of, but firmly established work methods are often accepted uncritically and attitudes about them are socially transmitted as a matter of tradition that makes them highly resistant to planned change and innovation.

Factor #3: Rewards and Satisfaction. For Campbell and his colleagues, rewards and satisfactions, as a climate variable, are general and molar impressions that employees have of the organizations in which they work. We have already noted how in the study of the Emery Freight Company, positive reinforcement was used to encourage people to implement an innovation. There is an additional piece of evidence from a study by Gray (1971) which suggests that innovations are sensitive to the bonus rate used in the Scanlon Plan. A key element in the Scanlon Plan is employee suggestions, which often involve what we have been calling secondary innovations. Gray found that the number of suggestions in a large pressed steel plant fell substantially over a 1-year period, but that suggestion rate was closely correlated with bonus rate. As one would suspect, if people feel that suggestions have some payoff for them, they are more apt to make them. Gray is highly skeptical of the notion that participative leadership promotes suggestions and is more inclined to attribute differences in number of suggestions to the type of tasks and bonus rate. In any case, reward undoubtedly plays a role in both the generation of innovations and their implementation.

Factor #4: Consideration, Warmth, and Support. Innovation involves risks. To suggest an innovation, particularly before one has tested all of its implications, clearly requires a certain amount of courage. The initiator of an innovation is apt to be laughed at and ridiculed, sometimes even when the idea turns out to be a good one. Implementation of an innovation is often an act of faith, because no one is able to work out and predict all of the implications before the idea is tried out in a specific content. Prior success in other organizations reduces the risk but cannot eliminate it entirely. For all of these reasons, a climate that encourages risk, that is nonthreatening, that tolerates differences, and that is warm and supportive is most apt to be one that promotes innovation.

The Effect of Politics on Climate: The Case of Tizard and Cherwell

Innovations often become enmeshed in politics, which is to say that some individuals involved in the process use their political power to influence decisions for reasons that may be unrelated to organizational effectiveness. They may wish to promote a rival concept, believing that it is genuinely more likely to succeed. But often they are motivated by simple greed, or the obligation to pay off old political debts, or by personal animosity toward others involved in the decision. People may not even be aware of their own motivations in these cases. But such variables cannot be neglected because they frequently distort the judgment of individuals and have a decisive impact on the final decision.

Although the problem is particularly evident when governments are involved, especially when decisions must be made in times of crisis or under the cloak of secrecy, no single professional group is immune from the political virus; it attacks natural scientists, corporate executives, college administrators, and union leaders as well as elected officials.

The final decision with respect to an innovation is often made by a few men who debate the issue in secrecy. Commenting on this problem, C. P. Snow (1960) notes that:

One of the most bizarre features of any advanced industrial society in our time is that the cardinal choices have to be made by a handful of men: in secret...and by men who cannot have a first-hand knowledge of what those choices depend upon or what their results may be.

Snow recounts the struggle between Sir Henry Tizard and Lord Cherwell, two distinguished British scientists, who locked horns during World War II over the development of radar and the potential effectiveness of the strategic bombing of Germany. As it turned out, history demonstrated that Tizard was right in both cases, but he lost the argument over strategic bombing because Cherwell had the ear of Churchill and used his political influence to overcome the arguments of Tizard and other informed scientists who carefully rebutted his claims that strategic bombing could be decisive in winning the war against Hitler. Tizard was out of power at the time because his political loyalties lay on the opposite side of the aisle. Nevertheless, he wrote a devastating criticism of Lord Cherwell's basic document advocating strategic bombing. In the words of C. P. Snow:

Everyone agreed that, if the amount of possible destruction was as low as that calculated by Tizard, the bombing offensive was not worth concentrating on....It fell to Tizard to argue the case....I do not think that in secret politics I have ever seen a minority view so unpopular. Bombing had become a matter of faith....In private, we made the bitter jokes of a losing

side. "There were the Fermi-Dirac statistics," we said, "The Einstein-Bose statistics. And the new Cherwell non-quantitative statistics."

What the reader interested in innovation finds most fascinating about Snow's revealing personal insights in this study of the politics of invention and innovation is the extent to which Cherwell's deep hatred for Tizard apparently distorted his judgment on these matters. The two had met many years before in Berlin and, indeed, had become close friends there. But over the years the animosity between them grew for some unknown reason, and ultimately reached its peak during the war when Cherwell's relationship to Churchill gave him unusual power to promote his ideas and strike out at Tizard. Reading Snow's engaging description of these events, one finds merits of the innovations taking a backseat to the personality struggle between these two complex men.

Snow offers several antidotes to the problems he describes. He believes we should be careful not to give much power over the fate of important innovations to a few men, particularly when they show clear evidence of personality defects. But, above all, Snow believes we must avoid the two conditions that lay the foundation for self-deceit in these matters.

First, there is what Snow calls "the euphoria of gadgets." Men get carried away with ideas and gadgets, particularly those which they have invented or have a major personal stake in. To give such men great power in the final adoption decision is to invite disaster.

Second, there is what Snow calls the euphoria of secrecy. Openness is, of course, the key to informed debate, the acceptance of innovations, and their effective implementation. Secrecy gives an unusual sense of omniscience to the men who share the secret and are vested with the power to act on the basis of that information. Such men often assume that they have a power of insight that is greater than that enjoyed by other equally qualified outsiders. At the time of the Bay of Pigs, an operation which President Kennedy inherited from the Eisenhower administration, a small group of trusted individuals from both administrations were called together to consider the planned invasion of Cuba. Operating in secrecy, the group developed a high sense of mission that was untested by the sobering comments of others inside and outside of government. The entire operation might have been avoided if it had been subjected to more open debate (Janis, 1972). This episode in American history provides a number of examples of the way in which small groups operate, and we shall have occasion to refer to the work of Janis again later in this chapter.

From an organizational development perspective, Snow's biographical descriptions bring us back to the issue of the kinds of cultural conditions that promote innovations. We have noted how important openness and trust are to the development and adoption of effective innovations. In

the case of Tizard and Cherwell, the climate for innovation was, in a sense, terrible. The secrecy, of course, was a major factor. But the stakes were enormous. From the perspective of those involved, radar could spell the difference between survival and defeat for Britain; and the decision to engage in strategic bombing might cost hundreds of thousands of lives. Consequently, these men were willing to risk all and to engage in the most bitter and acrimonious debate. But, one suspects that less determined men confronting more mundane issues would be unwilling to contribute their ideas in such a climate. As a matter of fact, the feud between Tizard and Cherwell became so bitter and intense at one point that two Nobel Prize winners, A. V. Hill, the physiologist, and P. M. S. Blackett, the physicist, both resigned from the committee considering the development of radar rather than sit through the endless haggling over Cherwell's hair-brained ideas.

Cherwell was not one of the original appointees to the committee, which had moved along very well until Churchill insisted that he be given a place on it. "Almost from the moment that" (Lord Cherwell) "took his seat in the committee room, the meetings did not know half an hour's harmony or work undisturbed," according to Snow. The debate continued until the two Nobel Prize winners realized that the personal animosity between the two men was obstructing all hope of progress and resigned. They only returned to the committee after Cherwell was replaced by E. V. Appleton, an expert on the propagation of radio waves, who contributed not only invaluable scientific knowledge, but apparently helped to re-establish a climate in which innovation could flourish.

Educational Mechanisms for Creating an Innovative Climate

Two different types of educational mechanisms are commonly used to improve organizational performance depending upon whether the focus is on the task of the group or the climate (sentience).

Task and Sentient Groups. An important and useful distinction is sometimes drawn between task and sentient groups (Miller and Rice, 1967). Task groups contribute to the survival of organizations by performing activities that are essential to the organization's survival. Sentient groups, on the other hand, are those groups that demand and receive loyalty from their members. They are the groups to which people are committed, corresponding closely to what sociologists call primary groups. Sometimes sentient and task groups overlap more or less completely, as in a family-owned business, but sometimes sentient groups lie almost entirely outside of the organizations in which people hold formal membership.

We have noted that consideration, warmth, and support, which are often important properties of sentient groups, are also characteristics of organizations that encourage innovation. Organizational development has as one of its major objectives the development of these properties in the task group, not for their own sake, but for the contribution they can

make to organizational innovation and renewal. In other words, organizational development undertakes to make task and sentient groups more nearly coextensive.

The ideal is illustrated by small groups of men in time of war who become mutually dependent upon one another, such as the crews of bombers or submarines, and develop a strong sense of interpersonal trust, confidence, and affection, and a powerful commitment to the performance of their common task. Exhaustive interviews with German prisoners during and after World War II suggest that the Wehrmacht was sustained largely by the satisfaction of soldiers with their primary (sentient) groups (Shils and Janowitz, 1948). Contrary to what might be expected based on many articles written prior to the work of Shils and Janowitz, they found that abstract political ideals and symbols played almost no role at all in the determination of German soldiers to continue fighting. What counted was their loyalty to those around them, particularly their immediate comrades. A participant observer, who served with a rifle platoon in the Korean War (Little, 1964), confirmed the findings of Shils and Janowitz, concluding that the "buddy system" was generally the thing that helped soldiers through combat and contributed significantly to their effectiveness. In such cases as these, task and sentient groups overlap completely.

At the opposite extreme are those individuals who are never integrated into their task groups but remain on the periphery. They may work with others in a factory or organizational setting, but are not loyal to them. Sometimes they perform their tasks reasonably well, but often their behavior is disruptive and their performance slipshod. In their study, Shils and Janowitz found that such isolates were most apt to surrender or desert. And Little notes ironically that they were often rotated out of combat roles during the Korean War.

Tasks and Team Skills. Although the development of sentience is clearly important to the issue of organizational renewal, we should not neglect the development of task groups nor take them for granted. People must learn through formal training or experience the individual and team skills needed to participate successfully in task groups. By individual skills, I mean those skills that can be acquired outside of the context of a particular system, but are essential to the system's performance. Such skills include virtually all component activities taught in formal education or training settings from reading a radar scope or welding a pipe to the diagnostic skills of an internist or psychologist. Team skills, on the other hand, are generally learned in the context of a particular task group and involve the interactions of human beings with one another. Freed (1962) has developed a taxonomy that illustrates team skills, including load sharing, warning, filtering, adapting, etc. Both individual and team training make a substantial contribution to organizational effectiveness, but they are generally not considered to be methods of organizational development and will not be discussed in more detail in this chapter. There are times, however, when team training methods

shade over into organizational development, particularly when groups are encouraged to innovate and improve the ways in which systems operate (pp. 22-24).

Developing Sentience. A wide range of "educational methods" has been used to encourage the development of sentient groups. All successful efforts of this kind have one thing in common: they provide relatively informal, unstructured group experiences. The more task centered the activities of a group are, the less apt the group is to develop behaviors, beliefs, and attitudes associated with sentience. The major exception to this proposition is to be found in groups with highly routine tasks that permit unstructured activities to proceed simultaneously and in parallel with them.

One of the most widely used methods in organizational development for creating sentient groups is known variously as Laboratory training, Sensitivity training, and T-groups.

At its best, Laboratory training takes place in an isolated setting (retreat) where subjects can devote their full attention to it. Numerous variables that normally interfere with the evolution of sentient groups, such as role and status differences, are either eliminated, ignored, or rejected by the group. As a result, Laboratory training provides a highly distilled experience in which one can often witness the rapid evolution of a sentient group.

One of the essential characteristics of Laboratory training is that it is unstructured. While the leader may set broad objectives for the group, no agenda structures its activities. Without assigned roles and with no formal agenda, tension inevitably mounts; people become anxious and grope for ways to make the experience meaningful.

Since actions taken to foster sentience may interfere with the performance of task groups, it is crucial to maintain the boundaries between them and insure that these boundaries are easily discriminated. For this reason, activities designed to promote sentience are often carried on outside of the formal organization setting.

But far too often, retreats are overorganized and, hence, merely reinforce or cultivate task groups. The more attractive the setting, the greater the danger that this will happen. No one wants, or dares, to leave others with the impression that a group assembled on San Francisco or Grand Traverse Bays in order to enjoy the setting or the fellowship. Consequently, schedules are filled from morning to night with intensive, generally one-way, information-packed learning experiences, even though it is clear that they overload one and all. Roles are carefully maintained because those in power are concerned that if they let down the barriers, they will not be able to re-establish them when they return to the regular organizational setting. Unfortunately, such retreats are often a waste of time.

But sentience is not an unmixed blessing. When sentient and task groups overlap and people find deep satisfaction in them, some innovations will be resisted, particularly those that threaten to realign personnel

and disrupt well-established interpersonal relationships. Another reason sentient groups resist change is that such groups often allow people to fantasize and engage in speculative free association that approaches a form of play without forcing them to defend their ideas (Gosling, 1979). Since playing with ideas is enjoyable, people may not want to see a sentient group formed for this purpose broken up. Unfortunately, the decision to act on an idea almost always closes out fantasy, greatly reduces the number of degrees of freedom to act, and sets the group on a fixed course that may dissolve the sentient group itself. Consequently, the group may resist or even sabotage the change process.

Miller and Rice suggest that if organizations are to remain adaptive under circumstances such as these, "the greatest sentience must remain in the group committed to change" (p. 260). Presumably the commitment is to changing others. Another option is to try to create a total organizational commitment to change. Sometimes, the Scanlon Plan succeeds in setting up autochthonous processes that support change throughout an organization, but it is relatively rare to see this happen in older, well-established organizations. Early in their life cycle, small businesses sometimes manage to cultivate both task and sentient groups, but they often do not last. This is a major point made by Miller (1979) who studied a small plant in New York established in the mid-1960s that had achieved a high level of productivity and morale by creating a "family" atmosphere. As we noted earlier, Miller believes that worker commitment was sustained in this plant in their "Utopian fantasies." But after 15 years, the fantasies were beginning to wear a little thin and the future looked a bit tarnished: the new approach could not solve all of the plant's problems and even generated a few. Also, as people settled into positions, the chances for rapid promotion dropped dramatically.

Miller and Rice comment on this phenomenon with the following observation: "They (the people in new, innovative small businesses) are prepared to work long hours for little money because of their belief in their cause. In time, other sentient groups exert their pull--family, other jobs, established professions--and members leave; those who remain struggle on, but unless new ideas and new leaders emerge, the institution can easily be submerged and become indistinguishable from its contemporaries" (p. 258).

THE PROBLEM SOLVING COMPONENT OF ORGANIZATIONAL DEVELOPMENT

Effective problem solving for organizational renewal involves three basic steps or stages. First, the problem must be clearly defined and stated in terms that are unambiguous. Second, having defined the problem, one must search for solutions that will satisfy the needs that have been identified. And third, alternative solutions must be evaluated in an effort to establish not only their effectiveness, but their unanticipated consequences for the organization.

A number of sophisticated techniques have been developed for identifying and clarifying problems, including structured interviews, surveys, problem posting, nominal groups, simulations, and task analyses. Each of these techniques is generally treated separately, but a common underlying strategy often guides their use. I call this strategy discrepancy analysis. It will not be possible to describe these techniques in detail in this chapter. For our purposes, it will be more useful to illustrate how some of these techniques are used for discrepancy analysis and the identification and clarification of organizational problems.

Our understanding of how solutions are generated once a problem is defined is, at best, sketchy. Change agents sometimes use the same techniques that are recommended for problem identification to stimulate the production of possible solutions to problems. Also, the cultural and psychological requirements for good problem solving can be described to some degree. Indeed, we have already addressed some of the cultural requirements in our discussion of the establishment of a climate for organizational renewal.

Finally, the literature on implementation and testing has been growing rapidly under the general rubric of evaluation. Evaluation is a topic which deserves a volume in its own right. Unfortunately, I do not have the space needed to address this subject in detail and will have to limit my comments to the important and neglected topic of survivability of innovations once the adoption decision is made.

Variance Identification: The Basic Strategy of Discrepancy Analysis

When an organization has a problem, an existing state of affairs deviates in some way from an established ideal, model, criterion, or standard. The standard may be thought of as an established boundary from which variances are assessed. Initially, the real nature of the variance is often poorly defined and those who recognize the problem may not have any concrete evidence that it exists, and even if they collect such evidence, they may find that it is not convincing to others because there is little or no agreement about its validity or standards of comparison.

Before an organizational problem can be solved, people must agree on boundaries and the extent to which actual performance deviates from them. In other words, they must fully define the variances that they are trying to reduce.

Four Examples of Methods to Identify Variances

This relatively simple principle is what ties together such apparently diverse techniques as surveys, simulations, task analyses, and open-ended methods when they are used for the purpose of improving

organizational performance. Each of these techniques has built into it: (1) a model of how things would be in the best of all possible worlds or how they should be, i.e., they set a standard; and (2) a way of assessing actual conditions. Four examples, one for each of the techniques, will help to illustrate this point.

Survey of Organizations. Staff members of the Institute for Social Research at the University of Michigan have developed a survey known as the Survey of Organizations that is now in its fifth (1974) edition.

The Survey of Organizations has been used in a wide variety of educational settings and has been the centerpiece of an intensive and systematic research effort at the University of Michigan for many years (Taylor and Bowers, 1972; Houser, Pecorello, and Wissler, 1977; and Bowers and Franklin, 1977). The theoretical underpinnings for the Survey of Organizations are to be found in the works of Rensis Likert (1961), particularly his System 4 Model. The focus on the model is on the human side of organizations, particularly people's expectations and the way in which they influence one another in organizations. Leadership and "the management system that emerges from that leadership process across persons and groups," according to Bowers and Franklin, are the "primary causal variables in organizational life" (p. 22).

From the theoretical foundations established by Likert, five areas have been identified that are believed to encompass the major variables that affect organizational performance: (1) organizational climate; (2) supervisory leadership; (3) peer leadership; (4) supervisory needs; and (5) a general category to encompass such variables as group processes, satisfaction, job challenge, etc. The survey contains 124 core questions designed to assess the characteristics of an organization with respect to each of these indices of performance.

If one were merely to provide an organization with the raw data from such a survey, that information, by itself, would not be very useful. For one thing, data of this kind need to be analyzed and summarized to make them meaningful to the user. But even more important, a basis for comparison or standard must be provided so that people can answer the inevitable question: Compared to what? In other words, to be maximally useful, the data must provide information about variances.

The change agents who employ the Survey of Organizations actually use two sets of standards. The first is implicit in the theoretical foundations of the survey itself, and the second set lies in the data base that has been collected for many years about how organizations of different types respond to the survey in the five areas identified above.

With respect to the first of these standards, the theory is normative and specifies modes of behavior that are most apt to improve organizational performance. For example, the theory gives primacy to human resources and assumes that an organization will be most successful if it

recognizes the creative assets of its people. When the survey asks, "How friendly and easy to approach is your supervisor?", the theory implies, at least, that the "correct" answer or standard is one that suggests that the supervisor values the employee as an individual and feels that he or she is worthwhile.

But operationally, the standard that is actually used to give feedback to organizations is a comparison with other organizations. In practice, this involves conducting a computer analysis that provides data about where the target organization stands with respect to others. Normally, this information is broken down into the indices described above and stated in percentiles.

Although such data may be useful in and of itself, it becomes much more useful when it is fed back to managers, supervisors, and employees and they are asked to problem solve about it. Because the survey is designed for general use, the data can only provide clues to problems; it cannot define problems precisely. Thus, knowing that an organization falls below the 25th percentile on Peer Leadership team building does not explain why this is true. To learn why one would need to explore that area with the organization's members in an effort to understand the problem in that specific organization.

The Survey of Organizations illustrates one important limitation of this approach to organizational renewal. The theory focuses problem solving on a specific class of variances, i.e., those that deal with the human side of organizations. Unfortunately, this violates one of the cardinal rules of creative problem solving, which holds that a problem should always be stated in such a way that it does not define a solution in advance. There is almost no way that such surveys can be used to define problems without focusing one's attention on a specific class of solutions, i.e., interpersonal solutions when, in fact, many of the organization's problems may lie on the technical side.

Simulations. The RAND System Training Program illustrates how simulations, like surveys, use discrepancy analysis to uncover and define problems. The program was the outgrowth of four experiments conducted in an abandoned pool hall in Santa Monica, California. From these inauspicious beginnings, it became one of the most successful organizational development efforts ever undertaken. The studies were originally conducted for the Air Force in the period 1952-53, and by the early 1960s the methods were used widely by the United States and its allies around the world to train air defense crews.

At the time, air defense was accomplished by a large number of radar sites, called Direction Centers, that were linked together and with fighter aircraft bases across the United States and Canada. Each site rotated crews of 25 to 35 men each through three shifts a day, 7 days a week, and 52 weeks a year.

Each of these sites performed three major functions. They conducted air surveillance, identified the aircraft entering their sectors by comparing their radar tracks with their flight plans, and intercepted those that were unknown to obtain a visual identification.

At the time of the RAND studies, the United States Air Defense system was not very effective. This fact was demonstrated in a variety of ways, not the least of which was the regular penetration of the system by aircraft of the Strategic Air Command of the United States which seemed to take particular satisfaction in demonstrating the helplessness of the Air Defense system against a determined attack by a well-trained and equipped "enemy."

The best single article describing the RAND experiments was written by Chapman et al. (1959), but the details of these experiments need not concern us here. Our focus is primarily on how simulation was used to identify problems in the Air Defense system and stimulate crews to develop effective solutions to them.

An important feature of the program was the capability to simulate dynamically realistic attacks on the radar scopes of Air Defense Direction Centers during training exercises. Each exercise lasted for 2 hours and involved an entire crew, each member of which performed his normal job as he would in real life. Since many sectors carried scores or even hundreds of aircraft in a 2-hour period, each traveling at different speeds and altitudes with a unique flight plan, the simulation effort was very great and could not have been accomplished without the use of high speed digital computers. The original studies, conducted in 1952-53, are, in fact, among the first examples of the use of computerized simulation for the purpose of improving organizational operations. By the early 1950s, the program was installed throughout the United States and simulated attacks were generated that permitted every site in the country to respond simultaneously to a coordinated and realistic air attack.

A variety of materials was furnished along with the necessary equipment and programs for simulating the attacks on the radar scopes. Since researchers knew when every flight appeared on and disappeared from a radar scope, and its exact speed and altitude, variances could be noted between what some called "God's view of the world" and the actual performance of the crew. Such aids permitted observers to take data on actual performance, analyze it by comparison with the "true" inputs into the system, and present discrepancies to crews for problem solving.

As in the case of surveys, the basic strategy is one of discrepancy analysis.

The following episode at a radar site that took place during an exercise in the state of Washington will illustrate how the system worked to uncover variances and solutions to them.

Shortly after the simulated attack began, it became evident that one of the men assigned to keep track of flights on a large plexiglass board was falling behind the traffic. Actually, the man had two jobs. In addition to keeping track of individual flights, he was expected to maintain an up-to-date record of available interceptor aircraft on an adjacent plexiglass status board. The data at the end of the exercise clearly indicated that the boards for which the man was responsible had not been kept current and they further suggested that this lag contributed to the poor showing of the crew in the exercise.

When the exercise was finished, the crew took a short break and then reassembled to discuss the variances observed which were presented to them without comment or interpretation. Because the data were objective and factually valid, crews almost never wasted time disputing them. Soon the crew zeroed in on the lag in posting tracks and fighter data, which I have just noted, and made a number of suggestions for improving the situation, including the addition of another crew member behind the board. At this point, the man who had had all the difficulty spoke up and said he really didn't think that it would be necessary to assign an assistant to him. The problem, as he saw it, was to remove the large communications cable that he tripped over every time he moved from one board to another. The crew chief immediately spoke up and denied that there was any such cable behind the board. A lively argument followed and the officer in charge suggested a sensible way of settling the dispute. Why not go and look? So the lights which were normally turned off around the clock were switched on and, sure enough, the unfortunate enlisted man was right. He had been tripping over a cable and it had interfered with his performance.

Now this may sound like an isolated or even improbable episode, but the fact of the matter is such simple problems often bring the biggest systems to their knees. In the course of the program's operation, crews at radar sites around the world identified literally hundreds of problems and solutions, some as elementary as the one I have just described, and others as complex as those reported by Chapman and his colleagues.

There is an important feature of the RAND work that deserves special attention in this context. A climate of openness and trust was created in the debriefings that followed every exercise, not in the hopes that it would somehow motivate better performance in and of itself, but because it encouraged the free exchange of information about problems and helped to insure that creative solutions would be suggested. To the extent that group dynamics contributed to the effectiveness of the organization, it was a bonus.

It is interesting to note that the RAND studies and the program that grew out of them are seldom cited in the literature on organizational development. One can only speculate about why this should be true. The experiments were conducted for the Air Force and a great deal of valuable military research of this kind has been neglected by social scientists (Parsons, 1972). The program's technology was far too expensive and

sophisticated to be used by individual graduate students in the pursuit of a dissertation topic, which means that there was little follow up research in university settings. Also, the studies were classified in the early stages, at least, and this inhibited the dissemination of the results. But perhaps most significantly, it was called the System Training Program which implied that the major thrust of the effort was traditional individual or team training when, in fact, it was really an effort at organizational renewal. At any rate, the program was highly successful and broke new ground that many change agents, even those in the military settings, have yet to integrate into their thinking about organizations.

Task Analyses. To some it may seem paradoxical to suggest using task analyses for the purpose of organizational development. A task analysis is, first and foremost, a roadmap describing the salient features of a task and how a particular job should be performed. As such, many people think of the task analysis as a highly structured, behavioristic tool for improving job performance. But, when task analyses are seen as a way of surfacing variances, it readily becomes apparent that they can be used for the purpose of organizational problem solving.

Since task analyses describe how tasks should be performed under different circumstances, they provide standards against which to evaluate performance. By observing actual performance and comparing it with the standard, one can identify discrepancies that need to be corrected. Whether one uses job incumbents for this purpose or experts, the effect is to identify problems and generate proposals for solving them.

The typical task analysis is used to describe how a single task is performed, but it is not essential that the analysis be limited in this way. While detailed step-by-step descriptions are often essential for designing effective training programs and training aids, for the purposes of organizational problem solving it is often useful to treat larger units of behavior describing the interactions of two or more people involved in the performance of more comprehensive task-units.

Steiner (1972) has described a formula for estimating the productivity of task groups that involves a discrepancy approach of the type being considered here. Steiner assumes that actual productivity of a task group is determined by the resources available to the group minus "losses due to faulty process." In order to evaluate a process and determine whether or not it is faulty, a standard description of how the process ought to be performed must be available. By comparing the standard with actual performance, one is able to arrive at some estimate of loss due to "faulty process." Unfortunately, Steiner does not address the major issue raised in this chapter: the use of discrepancy analysis to encourage the discovery of innovations that dramatically increase productivity.

Discrepancy analysis has been used at Michigan State University in an effort to improve classroom learning as the following examples illustrate.

Consider first the activities that a teacher and student must perform if the standard lecture method is to work. If one carefully observes this system, it is possible to identify 100 or more behaviors that are important to its success. Some of these behaviors must be performed by the teacher; and some must be performed by the students. In many cases, the two must interact together for the system to operate effectively. The teachers' activities range from such things as preparing lectures to providing feedback. The students' activities range from reading assigned material to preparing for tests. If either the teacher or a student fails to perform any of his or her assigned activities, the system will not work as well as it otherwise might have. A system task description identifying these required steps can be used with students and faculty to get them to identify discrepancies and problem solve about teaching-learning situations in an effort to improve their functioning.

In some cases, one need only identify a few steps and the discrepancies that exist in order to set the problem solving process in motion. Some years ago, a department chairman at Michigan State University approached our group because he was having considerable difficulty accommodating students in his overcrowded radio broadcasting laboratory. His intention was to ask the central administration for a second laboratory, but he thought he'd try to find another solution first. The problem was caused by the large number of students who arrived simultaneously at the laboratory for scheduled instruction. The students complained because they couldn't follow the lecture-demonstrations and did not learn to use the equipment. With the chairman's permission, we performed a discrepancy analysis which compared the ideal with the actual situation. The task analysis itself, i.e., the ideal, only contained a few steps such as these: (1) students arrive in the classroom; (2) demonstration is presented; (3) all students see, hear, and understand the demonstration; (4) students are given the opportunity for immediate practice on the task, etc. Alongside each step in the ideal description we described what actually took place when students arrived in the class. The chairman was then encouraged to discuss this analysis with faculty and students and solicit their suggestions for improvements. Rather than request a new laboratory, the department decided to test an independent study mode which would permit students to arrive at the laboratory at any hour, thus alleviating the overcrowding. The idea worked and the idea of a new laboratory was shelved.

Task analyses of this kind have not been widely used for the purpose of organizational problem solving. To my knowledge, the only writer who has described a method similar to this one in any detail is Gilbert (1974). In addition to stressing the importance of such discrepancy analyses at all levels in an organization, Gilbert's basic system focuses considerable attention on the problem of identifying those areas which are apt to yield the maximum payoff for a given amount of effort and attention in organizations.

Open-ended Methods. Another procedure which is commonly used for identifying variances and discovering solutions to them is to ask people more or less directly. Since individuals in groups stimulate one another to think of new ideas, elaborate on the suggestions of others, and confirm or disconfirm individual perceptions, groups are often used for problem solving.

When groups are asked to attack a problem head-on, standards and data are often ignored initially. In order to encourage the maximum production of as many creative suggestions as possible, members are urged to hold their critical comments regarding the ideas proposed. But, free association produces so many ideas that sooner or later they must be reduced to a manageable number, and one of the most important criteria for screening ideas is the extent to which any given idea agrees with the facts (Maier, 1960). In other words, to be effective open-ended methods, such as brainstorming groups, must sooner or later use something akin to discrepancy analysis to establish the validity of problems and suggestions.

A number of authors have described a variety of specific open-ended methods using groups to identify problems and solutions. Many of these techniques are sophisticated variants of the basic method known as brainstorming (Osborn, 1957). Brainstorming is a technique that encourages individuals in groups to generate ideas as rapidly as possible. Osborn laid down a few general principles for brainstorming that have been incorporated into many subsequently developed methods. To encourage free-wheeling and the production of the maximum number of ideas, he insisted that suggestions should not be judged during the brainstorming session, but afterwards. Criticism is ruled out during brainstorming but members of the group are encouraged to elaborate on ideas or combine them.

Recent innovations in this area have been directed primarily at facilitating the brainstorming process and overcoming some disadvantages of Osborn's approach. Maier, for example, has long stressed the importance of focusing on problems early in the process rather than solutions, and he has suggested several useful techniques for posting the ideas as they are generated (1963). The Delphi Technique permits an investigator to gather inputs from individuals and evaluate them without bringing them together in a group. Another technique, known as Nominal Groups, overcomes the tendency of one or two individuals to dominate the group by having people work alone to generate their ideas before sharing them in a round robin fashion that allows everyone's original ideas to be considered but skips those that have already been discussed (Delbecq et al., 1975). And so on.

What should be noted here is the fact that open-ended techniques, like the other methods described above, can be used to develop an inventory of problems and solutions. Although open-ended techniques inevitably have some structure and differ among themselves in this regard, they are all less structured than surveys, simulations, and task analyses. The latter have the advantage of providing the group with objective data about its own operations that can be "chewed on" and used to discover problems

and solutions more or less inductively. Open-ended methods, in contrast, get to the point more directly and use the group to define problems and to prioritize them and to establish the reliability and validity of individual suggestions.

All of the methods described in this section can be used legitimately to facilitate problem solving. Each of them has advantages and disadvantages. The central objective in organizational renewal is to get people involved in solving the problems of organizations. As a general rule, nothing captures the imagination of people more effectively than presenting them with some clues, perhaps mere fragments of a tantalizing puzzle, and asking them to join in the creative act of spinning out possible solutions to problems that impact directly on their lives.

Discovering Solutions: Some Requirements

Once an organization recognizes a problem, a search is often undertaken for ways to correct the observed variance. The search may be described from either a psychological or a social perspective. In other words, one may focus either on the individuals involved and how they discover innovations, or one may consider how the group hinders or facilitates the discovery process. These two perspectives are generally discussed in the literature under the headings of individual and group problem solving, respectively.

The Psychological Perspective. When people face a difficult and unique problem, they often grope for a long period of time before they quite suddenly discover a solution to it. When this happens, they are said to have had insight. It is generally noted that the solution in such cases involves the conjunction of two ideas or elements that have not been previously joined together. In the well-known studies of Kohler, for example, chimpanzees had the problem of obtaining a banana hanging from the ceiling of their cage just out of reach. Several boxes were available in the cage and could be stacked so that the chimpanzees could reach the banana. Providing the chimpanzees have had previous experience stacking boxes, they are generally able to put the two ideas together and solve the problem.

Homer Barnett, a sociologist who gave a great deal of thought to the psychological as well as the social and cultural variables that influence innovation, expressed it in this way:

When innovation takes place, there is an intimate linkage or fusion of two or more elements that have not been previously joined in just this fashion, so that the result is a qualitative distinct whole. (1953, p. 181)

The notion that innovation involves the fusion of two previously unlinked ideas is nicely illustrated by Maier's two-string problem. A subject is asked to join two strings together that are hanging from the

ceiling and spaced so that if the subject holds the end of one string, he or she cannot reach the other. By merely looking at the strings, subjects can see that they are long enough to be tied together, but their first attempts to bridge the gap by reaching from one to the other soon convinces them that their arms are not long enough. If a small weight, such as a pair of pliers, is available to them, however, many subjects soon discover that they can tie the weight to one string and use it as a pendulum. They swing the pendulum, walk over to the other string, wait for the pendulum to reach them, grab it, and tie the two strings together. Some subjects never arrive at this elegant solution because they cannot fuse the idea of a pair of pliers and the idea of a weight for a pendulum. They are so fixated on the more common uses for pliers that the new use does not occur to them.

Two implications can be drawn from such problem solving research. First, past experience with the elements needed to solve the problem is essential. But, if people have had too much experience or if they are too rigid, they may not consider alternative uses for the elements. And second, the elements or ideas that may contribute to a solution must be present in the problem solving situation; they must be paired with the problem, either symbolically or physically.

There are two reasons why it is necessary for the elements to be juxtapositioned. First, the elements are sometimes needed to actually implement the solution, as in Maier's two-string problem. Without a weight, it would have been impossible for subjects to actually construct a pendulum. But second, the elements stimulate, by association, the production of ideas for unusual solutions that might not otherwise have arisen. A subject sees the pliers in the two-string problem, for example, and wonders how they might be used to solve the problem. If a small weight had not been present, the subjects might not have thought of constructing pendulums.

Group Factors That Hinder or Facilitate Problem Solving. If groups are to problem solve effectively, organizational conditions must encourage the linkages and fusion of elements described by Barnett. I have already suggested that organizational innovations are most apt to arise in settings that are participative, accepting, and encouraging. Why should this be true? And what factors in the environment are likely to hinder the discovery of innovations?

In a recent review of the literature on problem solving in groups, Hoffman (1978) makes the following observation: "The major barriers to effective problem solving are those conditions which prevent the free expression of ideas in a group" (p. 68). He then goes on to identify some of the major factors that hinder group problem solving, four of which bear directly on the issue at hand.

First, groups tend to value unanimity and to enforce majority rule. As a consequence, individuals may go along with the group solution without voicing their own, often valid, objectives. As a matter of fact, the

majority may even suppress the expression of alternative solutions, particularly in cohesive groups, that operate in secrecy. Janis (1972) calls this phenomenon "groupthink." On the basis of his postmortem examination of the Bay of Pigs crisis and the deliberations of a small group of advisors to President Kennedy at that time, which was mentioned earlier, Janis concluded that dissent in the group was stifled by the momentum that gathered in support of a particular solution. Some of those attending the meetings felt threatened or uncomfortable in this situation and lacked the needed confidence to express their views. As a consequence, the group arrived at what was later agreed to be a poor decision. Recognizing that the group had not functioned very well and that his presence at the Bay of Pigs sessions had inhibited the free exchange of information, President Kennedy did not attend the early meetings of the group that debated the presence of soviet missiles in Cuba and he laid down various ground rules to encourage more open debate during those meetings.

People go along with the majority for a variety of reasons, including fear of rejection, the need to be accepted, and lack of confidence in themselves. The novice is in a particularly difficult position. In the presence of people who have successfully dealt with other, often similar, problems in the past, the new member of the group often finds himself or herself conforming with the more experienced members. In the presence of people who have successfully dealt with the same or similar problems, an inexperienced person tends to accept the demonstrated competence of the other person and follow his or her lead (Mausner, 1954).

A second set of factors that hinder effective group problem solving is the tendency of some people to dominate the discussion. Self-confident individuals may prevent the group from fully utilizing the information available to it by aggressively advocating their own position. Unfortunately, there is evidence to suggest that groups which have high status and dominance needs tend to be less productive and more dissatisfied with their functioning and outcomes than groups with low self-oriented needs (Fouriezo et al., 1950).

A third set of obstacles to effective problem solving has to do with the structure of groups, particularly their leadership. When a leader has the responsibility and the power to make the final decisions by himself, then his mere presence may inhibit the free flow of ideas and information. Anxious not to be caught on the losing side or appear to be disruptive, members of the group may watch the leader carefully for clues to his ultimate decision. Considerations such as these were behind President Kennedy's decision to remove himself from the early discussions surrounding the Cuban missile crisis.

Sometimes the leader defines the problem facing the organization in a way that incorporates his solution to it. (For example: How can we get our salesmen to drive fewer miles?) Or the leader may state the problem without a solution and then immediately offer one to the group. Behavior of this kind puts a damper on problem solving. When the leader

delegates responsibility to the group for finding solutions to problems, it is more apt to produce high quality solutions, show higher acceptance of the solutions generated, and be more satisfied with them than if the leader arrives at a solution and offers it to the group (Solem, 1958).

Leaders may hinder effective problem solving in other ways as well, particularly in those cases where they elect to conduct the problem solving sessions personally. The way in which leaders respond to suggestions made by participants can encourage or inhibit free discussion (Oakes et al., 1960). Their feedback will influence not only the individual who offers his or her opinion, but those who are listening as well. Nothing discourages people from participating in a discussion more effectively or quickly than ridicule or criticism by the leader of the ideas which are put forward.

A fourth and final obstruction to effective problem solving is the tendency of groups to move too quickly to a single solution which they accept too uncritically and without examining other alternatives. Something similar happens in the case of individual problem solving as well. When we try to solve an unfamiliar problem, we often arrive at a tentative "solution" that "ought to work" but doesn't, and find ourselves coming back to that "solution" over and over again despite the fact that it doesn't work.

Rather than spend time carefully defining a problem to be certain that it is clearly understood, the group often presses ahead in search of a solution. Once a solution is suggested that seems to suffice, the members often fixate on it and find themselves unwilling to consider alternatives. When groups are instructed to resist this natural tendency to leap at solutions and focus on the problem, they produce higher quality solutions (Maier and Solem, 1962). For this reason, experts in the area of problem solving generally encourage the group to define the problem fully and carefully before trying to solve it. Once the problem has been defined, the group looks for solutions. Finally, the solutions are screened (Maier, 1960).

At the start of this section I posed the question: "Why should we expect organizational innovations to be more likely to arise in an accepting and participative organizational setting?" Our analysis of the factors that hinder effective group problem solving provides us with a number of clues that can now be used to answer this question. First, in order to define a problem adequately, it is always useful to incorporate the perspectives of the various individuals who are affected by it. Each individual brings to the problem definition his or her own unique viewpoint. A given individual often possesses information about the problem that is not available from any other source and is essential to its clarification and solution. Second, in a participative setting, people are encouraged to offer their ideas freely and openly, and without fear of ridicule or attack. People who are involved in this way apply their individual creative talents to the discovery of new and innovative solutions, thereby multiplying the chances that an effective innovation will

be discovered. Third, once involved, many participants will search for appropriate prototype innovations that may exist outside of the organization and be adopted by it. Since each individual has many different encounters, the chances are improved that an effective solution of this nature will be found. Finally, open discussions of a problem increase the likelihood that accidental contingencies among elements will occur and fuse to produce innovations. People stimulate one another by suggesting previously unrecognized elements, new contingencies, and by elaborating proposed solutions.

IMPLEMENTATION AND SURVIVAL OF INNOVATIONS

Under ordinary conditions, organizational innovations cannot be sustained unless significant changes occur in the environment in which they are embedded. In part this is because infrastructures must be created to support them. Efforts to improve agricultural productivity in underdeveloped countries through the introduction of new seeds or fertilizers, for example, may require numerous environmental changes if they are to work, such as new or better roads, credit for farmers, and new markets for their products, etc. But the problem of implementing and sustaining change involves far more than the creation of suitable supporting mechanisms and services for innovations. Highly successful innovations, from the point of view of effectiveness or user attitudes, for example, are sometimes abandoned even though an infrastructure has been constructed to support them.

Successful Failures

Many successful innovations do not survive. It certainly helps the chances of an innovation for survival if it is successful, but success is not a sufficient condition for continuation. The following example from the psychological literature helps to make this point.

A relatively simple, effective, and economical cure for enuresis (bedwetting) has been known for about 100 years. Based on straightforward conditioning techniques, the method was demonstrated to be highly effective in a clinical setting by O. H. Mowrer in 1939 and described by him in 1950. Twenty-five years later, Baker (1969) visited the clinic and found that none of the pediatricians were still using the method. So Baker set up another experiment and once again demonstrated the effectiveness of the method. Whether the innovation will survive this time around is uncertain. What remains incontrovertibly true is that this successful innovation just disappeared. It was not replaced by something better. It vanished in that setting.

How are we to account for such "successful failures" as the one which I have just cited?

Scattered throughout the literature on innovation there are a number of studies that cast some light on this question. But only a few of these studies use examples from the area of organizational development. Therefore, I will draw on the wider literature here and describe a few examples from the field of education that offer a partial answer to the question I have just raised. Then I will close the chapter with some implications of these studies and one or two others for organizational development.

The RAND Corporation-USOE Study. Berman and his colleagues (1975) at the RAND Corporation recently completed a study of four massive innovation programs funded by USOE: (1) Title III, funded at \$120-190 million, was designed to encourage instruction innovation in elementary and secondary schools; (2) Right to Read, funded at \$12 million annually which focused on improving reading skills, particularly among disadvantaged youngsters; (3) Vocation Education, Part D, designed to enhance career awareness and reading, was funded at \$16 million annually; and (4) Title VIII, Bilingual Education which was aimed at helping children with limited English speaking ability and was funded at \$45-85 million annually.

National Opinion Research Center conducted a nationwide survey of 293 projects in 18 states for RAND. In addition, RAND personnel visited 29 of these projects and interviewed numerous federal, state, and local employees about these various programs.

The RAND study did not look directly at project continuation. They asked instead whether or not local school administrators intended to continue their projects after federal funds were removed. Project success had some relationship to continuation. Naturally, projects that are clear-cut failures are not apt to be continued. But many districts apparently have no intention of continuing a project, regardless of its success because the district is not prepared to accept the costs or the incentives are not adequate. As RAND goes on to note, "costs and political and bureaucratic acceptability were probably of equal importance (to success or failure)."

Another interesting outcome of the RAND study deals with implementation, not continuation. Implementation took several different forms: (1) in some cases the local educational setting and the innovation both were changed or modified; (2) the local educational agency sometimes emasculated the innovation and completely co-opted it to meet local needs without change; and (3) in other cases there was no implementation at all. In other words, funded projects sometimes didn't survive long enough to even get implemented.

RAND concluded that one of the most important determinants of both implementation and continuation was the extent to which the initiation behavior at the local level could be characterized as problem solving or opportunistic. In other words, did the local folks have a problem that they really were trying to solve, or were they just after federal money?

Significantly, differences in technology or resources made little difference to the successful implementation of a project in the RAND study. Local conditions were far more important.

To summarize some of the significant conclusions of the RAND study, the implementation of innovations involves a complex interaction between them and local organizations. Innovations were most apt to survive when they were adapted to the organization, focused on practical unmet needs that organizations recognized and wanted to attack, and encouraged local modification and tailoring of them and wide involvement of the people affected by the change efforts.

MIT and the Keller Plan. The Keller Plan is a method of independent study that is now widely used in this country and Europe to teach many different subjects. The method is based on research by Dr. Fred Keller, a well-known behaviorist and respected educator; it allows students to take a course by completing a series of self-study modules.

In the spring of 1969 the Education Research Center at the Massachusetts Institute of Technology (MIT) experimented with the Keller Plan for the introductory physics course. Within 3 or 4 years, the Keller Plan was used almost exclusively to teach the introductory sequence at MIT. The decision by the MIT physics faculty to adopt the plan attracted a great deal of national and international attention. Conferences were held at MIT to explain the plan to teachers of physics from other institutions. There were numerous visitors and a number of widely distributed publications describing the program. By 1973, the department had decided to abandon the plan. Why?

This question was recently asked, and at least partially answered, by four MIT professors who published a case study describing the rise and fall of the project (Friedman et al., 1976). Although we have never undertaken a postmortem of similar "failures" at Michigan State University, we have witnessed a number of them and believe that there are common causes. Therefore, it may be useful to identify some of the factors that contribute to the demise of apparently successful programs.

First, the effects of an innovation may radiate out and create problems in other courses. Competency-based instruction, for example, treats time as a variable, whereas most courses are taught in a fixed time period. Thus, students who fail to complete a competency-based course may be permitted to continue working after the final examination period. If students are allowed to continue studying into the next semester, the competency-based course will begin to interfere with subsequent courses. Students will spend time on the competency-based course that they should be spending on other courses; in addition, they may lack necessary prerequisite skill that should have been acquired. And so on. Inevitably, this leads to frustration and resistance toward the innovation. Something along these lines appears to have happened at MIT.

Second, some innovations challenge deeply held convictions of faculty members about human behavior in general and learning in particular. For example, PSI focuses on the teaching process and not curricular content which is the primary interest of most faculty, particularly those in the sciences. Also, the psychological assumptions underlying an innovation are generally not obvious in the early stages but after a period of use these assumptions gradually become more apparent to more faculty members. Thus, for example, the Keller Plan, which was used at MIT, is a model that is largely derived from a behavioristic orientation to learning. Many of the physicists at MIT were apparently unwilling to accept the underlying premises on which the model was based and thought it failed to teach certain intangible attitudes, values, and ways of thinking.

Third, PSI tended to alter the roles of some of the people involved in teaching physics, particularly the graduate assistants, forcing them to assume a more passive teaching posture and under-utilizing their skills and abilities. For these reasons, the assistants may not have been motivated to make the program work, and their commitment was essential to its success.

Fourth and last, although Friedman et al. do not make special note of it, innovations frequently consume more time and energy than traditional methods. As a matter of fact, this tends to be the case even when the innovation involves the use of hardware designed to increase "productivity." Many faculty members (and their departments) have no understanding of the extent of the commitment required until after the project is underway. Once the true implications are understood, the pressure to abandon the project increases.

A second study of the Keller Plan describes the longitudinal experience of a single faculty member at another institution with the plan, and highlights another reason innovations sometimes fail. L. L. Ainsworth is at Indiana University Southeast. He adopted a variant of the Keller Plan in 1975 and reported his experience in a recent article. What is perhaps most remarkable about this article is the author's persistence and the energy he devoted to trying to make this innovation work. In the face of overwhelming odds, an indifferent administration and a student body that, on the whole, was unprepared to take on individualized learning of this kind, Ainsworth tried the Keller Plan again and again only to fail. Many educational innovations sound good on paper but the deck may be stacked against them: they may require too much time, support from the administration, or students who really want to learn and are prepared to commit themselves to the task. I recall attending a UNESCO conference in Amsterdam almost a decade ago. We were discussing all of the new innovations in higher education when one of the student observers interrupted and politely asked if we weren't making some assumptions about their learning skills and motivation to learn. We were all impressed and interested in the comment, but after a while, it faded into the background and we went right on with our conference as if the students didn't exist. Many innovations in higher education, in industry, and the military are

variant forms of independent study--and many students in this generation lack the skills and motivation to engage even the best designed learning modules on their own.

Some of the implications of the studies which I have just described are relatively obvious and have been supported by the observations of OD practitioners (in parentheses):

- If they are to survive, organizational development interventions must be tailored to meet real needs that are recognized and accepted by organizations.
- To survive, innovations must be understood by the people who are expected to use them or will be affected by them, and those people must be encouraged to participate in the adoption decision (Gilson and Lefcowitz, 1957).
- To survive, innovations must work, and the likelihood of their working can be vastly improved if they are based on (tested) theory (Frank and Hackman, 1975).
- Innovations stand a better chance of survival if they are "legitimized" within the organizations by formal regulations, policies, structures, budgets, and similar linkages that bind them in.

Implications for Organizational Development

Even if one follows all of these prescriptions, there is still no assurance that an innovation will survive. As a matter of fact, the Keller Plan at MIT probably met all of the criteria that I have just listed. This brings us to the final point about the survival of innovations and the one that offers the greatest difficulty. If innovations are to survive, substantial changes must take place in the environment to make it compatible with the proposed change. At one level, this may mean nothing more than making certain that organizational practices "fit" the innovation, e.g., that the incentive structure of the organization is compatible with the innovation and rewards its use. But when achieving compatibility between the innovation and the organization requires that people change, that roles be altered, or values be modified, or power be redistributed, formidable difficulties surface almost immediately.

According to Eric Miller (1979) the primary task of a development program is to help the client system to increase its control of its environment. Seen in this light, all development, whether of organizations or groups or individuals involves changing the environment in which people operate so that roles are redefined and power is shifted. To quote Miller directly on the topic of organizational development and power:

Our proposition tells us that unless there is change in the relatedness of the group (receiving OD) to its environment--a change in the direction of greater potency--the internal improvements in relationships will not be sustained. If the group is a senior management team, the hope for outcome is greater potency in relation to customers, competitors, or suppliers. If, however, this outer boundary is intractable, then it is predictable that either the management team will direct its energies into conflict with other groups within the enterprise--for example, trade unions--or it will regress. If on the other hand the group being "developed" lies not on the boundary of the enterprise but inside it--for example, a production department--so that its environment consists of other departments, then "successful" internal development will depend on changes in relationship with one or more of those departments. The resultant conflict may well be productive, though it is often unwelcome because it calls into question the established "mobilization of bias." My point is that, although many people may wish it otherwise, organizational development cannot be effective without also being a political activity, involving changes in power. Whether he is aware of it or not, the OD consultant is implicated in that activity. (p. 231)

Eric Miller's quotation and the ideas set forth in this chapter help to give us some perspective on the role and responsibilities of change agents. If the objective is to improve the organization's operation, then the change agent has an obligation to insure that his or her interventions genuinely make a difference and that the resulting changes, particularly the organization's innovations, can be sustained. Interventions, aimed at isolated individuals or groups, are unlikely to facilitate organizational renewal or to endure. Nor should such interventions be promoted and offered by "practitioners" who have no grasp of the complexity of the change process.

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Ainsworth, L. L. Self-paced instruction: An innovation that failed. Teaching of Psychology, 6 (February 1979), 42-46.

Despite frustrating results and little administrative support, Ainsworth tried repeatedly to make the Personalized System of Instruction (PSI) work. In the end, he failed. He concludes that PSI is not suited to many students entering college because they lack the necessary motivation and ability to undertake independent study activities of this nature. PSI is apparently best suited to high ability and other outstanding students who need it least. Since self-paced courses are generally designed to be easy to understand and pass, the failure of many students to succeed in them suggests that their academic preparation and motivation is "woefully inadequate." Article illustrates that users of an innovation must have the skills to take advantage of it, and change agents must be certain that the innovation is matched to users.

Baker, Bruce L. Symptom treatment and symptom substitution in enuresis. Journal of Abnormal Psychology, 74 (1969), 42-49.

Conditioning treatments for bed-wetting have been reported by many investigators but they are not widely used because of fears of "symptom substitution," i.e., fear that a relapse or new symptom will arise. Thirty enuretic children were treated in this study using either conditioning (experimental group) or by other methods designed only to duplicate the motivational aspects of the experimental group (control group). Conditioning was superior to the other methods. In addition, on several measures of adjustment children actually showed improvements, e.g., they were reported to be happier, more grown-up and venturesome. Study does not deal directly with innovation but McClelland (1978) reports that Baker did his study in the same clinic where Mowrer conducted his original successful studies some 30 years earlier, but Mowrer's innovation was abandoned for unknown reasons.

Barnett, Homer G. Innovation: The Basis of Cultural Change. New York: McGraw-Hill, 1953.

Early and well-known text in the area of innovation that treats it in a very broad way, defining innovation as "any thought, behavior, or thing that is new because it is qualitatively different from existing forms. Strictly speaking, every innovation is an idea or constellation of ideas." Since this definition includes most creative acts by humans, the book deals in great detail with the creative process and how ideas are generated. Barnett approaches the problem from a broad social science perspective to look at creativity and the impact of culture on the adoption and diffusion of innovations. Although most authors today limit the concept of innovation more than Barnett does and there has been a great deal of research on the subject since this text was written, the book contains much useful information and many insightful observations.

Bartlett, Fredric Charles. Remembering: A Study in Experimental and Social Psychology. New York: The Macmillan Company, 1932.

This classic study reports Bartlett's experiments in the areas of imagery and recall which were undertaken at Cambridge in the early 1900s. Bartlett's methods were devised after he became frustrated with the approach of Ebbinghaus who relied primarily on nonsense syllables. The book describes five basic methods for studying imagery and remembering and presents a theory of remembering as well. The central theme developed in Bartlett's theory is that memory is not reproductive, but is constructive. Literal recall, Bartlett found, is relatively rare; instead people tend to reconstruct the past and in doing so modify it greatly. Incoming stimuli cause people to "turn round upon (their) own schemata and to reconstruct them afresh." Often recall is based on some general impression of the whole or attitude toward it that is rooted in feeling and affect. "Recall is then a construction made largely on the basis of this attitude, and its general effect is that of a justification of the attitude." (p. 207)

Bennis, Warren G. Organization Development: Its Nature, Origins, and Prospects. Reading, Mass.: Addison-Wesley Publishing Company, 1969.

One of a series of books designed to give readers some idea of the scope of organizational development. Written largely from the point of view of practitioners in the field, the series stresses techniques, applications, and practical examples. This volume sets the tone for other books in the series. According to Bennis, "Organizational development is a response to change, a complex educational strategy intended to change the beliefs, attitudes, values, and structure of organizations so that they can better adapt to new technologies, markets, and challenges." Strong emphasis is placed on the central role of the change agent and his values about humans in organizations. Approaches the description of organizational development by posing and answering a series of questions in an informal and personal way about assumptions, goals, steps, and role of the change agent. Although Bennis stresses that organizational development is not just sensitivity training, considerable emphasis is given to it.

Berman, Paul, Greenwood, Peter W., McLaughlin, Milbrey, and Pincus, John. Federal Programs Supporting Educational Change, Volume IV (Abridged): A Summary of the Findings in Review. R-1589/4-HEW (ABR.). Santa Monica, Calif.: The Rand Corporation, April 1975.

This report summarizes an evaluation by the Rand Corporation of four massive federal educational programs: (1) Title III (\$120-\$190 million annually) to introduce educational practices; (2) Right-to-Read (\$12 million annually); (3) Vocational Education (\$16 million annually); and (4) Title VII, Bilingual Education (\$45-\$85 million annually). After an extensive review of the literature, a nationwide survey in 18 states of 293 projects, field studies at 29 sites, and Rand staff interviews with federal and SEA officials were conducted. The authors looked at perceived success, changes in behavior, fidelity of implementation, and expected continuation. Some significant conclusions: (1) search for solutions characteristic of problem solving did not occur; local staff seemed to know what was possible; also, money was seen often as an opportunity to get funds, not to satisfy a deeply felt need; (2) implementation stage was not a simple application of a known technique but a complex

interaction between the organization and the innovation; (3) effective implementation was most apt to occur when the innovation was adapted to the organization; (4) incorporation was most likely when the project involved training (not technology) and focused on practical issues rather than theory and encouraged local development and wide involvement of the staff. Resource level and type of treatment (technology) had relatively little effect on project outcomes. A receptive institutional setting (climate) and "mutual adaptation" were keys to serious and sustained change. Internal and local factors were paramount over others. If the project was too complex or its values and goals were not consonant with participants, or its objectives did not match distinct objectives, the project was unlikely to be implemented successfully.

Blake, Robert R., and Mouton, Jane Srygley. Some effect of managerial grid seminar training on union and management attitudes toward supervision. Journal of Applied Behavioral Science, 2 (1966), 387-400.

Before and after two one-week seminars, a forced choice questionnaire was administered to 33 managers and 23 union members from the same plant. Subjects read The Managerial Grid by Blake and Mouton and were involved in a variety of structured learning experiences to help them understand grid theory. Management and union scores differed significantly before and after training. Managers tended to emphasize production more than did union members who were more oriented to people. The attitudes of both union and management changed as a result of the seminar, but managers' attitudes changed more than union members. Both groups moved to a greater emphasis on production, but the authors note that the two groups have fundamental differences over what constitutes sound supervision with union members stressing concern for people.

Blake, Robert R., and Mouton, Jane Srygley. Grid OD: A systems approach to corporate excellence. In Harvey Hornstein, Barbara Bunker, W. Warner Burke, Marion Gindes, and Roy J. Lewicki (eds.), Social Intervention: A Behavioral Science Approach. New York: The Free Press, 1971, 401-419.

A summary article about Grid OD presented to the McGregor conference in 1967. Authors define the purpose of OD: "To achieve an excellent corporation." After citing a number of barriers to excellence (communications and planning particularly); the authors point out 4 significant components of corporate culture that are essential for excellence: (1) knowledge of behavioral theories; (2) behavioral science instrumented implementation; (3) knowledge of business topic; and (4) management science. They then go on to show how Grid OD develops these four sides in its various phases. To clarify what Grid OD is, it is compared and contrasted with the T-Group consultant method. Grid OD attacks the total culture (not just the behavioral), affects every member of the organization using "cultural carriers," relies heavily on instrumentation, and is more structured.

Blake, Robert R., Mouton, Jane Srygley, Barnes, L. B., and Greiner, L. E. Breakthrough in organization development. Harvard Business Review, 42 (1964), 133-155.

A frequently cited study of Grid OD. Blake and his colleagues presented their program to 800 managers in a 4,000 employee division of a large petroleum

corporation. Numerous measures of perceived changes in work group performance and attitudes were taken. Although employees were asked to estimate changes in their perceptions from pre-to-post study time periods, no pretest data were taken. Authors collected objective data about operating costs, plant safety, profits, transfers, etc. Results support the value of Grid OD. Profits increased and about 13% of that increase was attributed to improved operating procedures and might be attributed to OD. Values shifted toward 9/9 on the Blake-Mouton model, frequency of meetings and transfers increased.

Bowers, David G. OD techniques and their results in 23 organizations: The Michigan ICL study. The Journal of Applied Behavioral Science, 9 (1973), 21-43.

A five year longitudinal study of 23 organizations using different OD treatments. Results are based on data from more than 14,000 respondents. The Survey of Organizations questionnaire was used to measure organizational functioning before and after OD interventions. The results indicated that survey feedback was associated with statistically significant improvement on a majority of measures, as was interpersonal process consulting. Laboratory training and task process consultation were not associated with significant changes. As a matter of fact, Laboratory Training was negatively related, i.e., organizational functioning declined. The impact of these various treatments, particularly Laboratory Training, was shown to be contingent in part on organizational climate.

Bowers, David G. and Franklin, Jerome L. Survey-Guided Development I: Data-Based Organizational Change (revised edition). La Jolla, Calif.: University Associates, 1977.

An introduction to survey-guided development that provides a useful overview of the Survey of Organizations and the theoretical foundations upon which it is based. The Survey of Organizations is derived from the work of Rensis Likert who regards leadership and the management system that results from that leadership as the primary causal variable in organizations. In addition to describing the theoretical foundations for this survey, the book discusses such topics as the role of the change agent, survey feedback and how it is presented, and problems involved in evaluating organizations. Closes with a discussion of the evidence in support of the Survey of Organizations and suggests some needed areas for additional research.

Bragg, J. E. and Andrews, I. R. Participative decision making: An experimental study in a hospital. Journal of Applied Behavioral Science, 9 (1973), 727-735.

A study of participative decision making (PDM) in a hospital laundry that follows Lowin's model in an effort to improve productivity. The major vehicle for change is participative decision making focused on eliciting and evaluating "suggestions" of employees in the laundry. Of 147 suggestions, ninety concerned work flow, and forty-four involved equipment modifications. Productivity rates for the PDM laundry and two control laundries were compared after 12 months and 18 months as measured by pounds of laundry handled per

employee hour. PDM laundry showed significant improvements in productivity compared to controls. Also, the PDM laundry showed a significant improvement in employee attitudes and a significant decline in absenteeism.

Brayfield, Arthur H. and Crockett, Walter H. Employee attitudes and employee performance. Psychological Bulletin, 52 (1955), 396-424.

Authors note that there has been a great deal of work on employee attitudes and there is a common assumption in the literature that employee attitudes bear a significant relationship to employee performance. Brayfield and Crockett set out to summarize and examine the empirical literature bearing on this assumption. They review a number of studies of performance on the job, accidents, and employment stability and conclude: (1) "That satisfaction with one's position in a network of relationships need not imply strong motivation to outstanding performance within the system," and (2) "productivity may be only peripherally related to many of the goals toward which the industrial worker is striving." (p. 42) Authors conclude with a comment on the complexity of worker motivation.

Campbell, John P. and Dunnette, Marvin D. Effectiveness of T-Group experiences in managerial training and development. Psychological Bulletin, 70 (1968), 73-108.

One of the most systematic and thorough reviews of the literature on the effectiveness of T-groups ever undertaken. The focus of the review is on T-group use for management development. After describing the nature of T-groups and underlying assumptions, the authors review the results of 44 studies divided into those that examined primarily internal criteria (personal change unlinked to job performance) and external criteria (impact on job performance). The evidence suggests that T-groups do affect "back-home" behavior, but it is difficult to specify exactly how. People appear to change in different ways; and there is not convincing evidence that their job performance improves. Indeed, in the one study available at the time (Underwood, 1965) the results suggest that there may be more negative job related changes than occurred in a control group. The results for internal criteria were even less conclusive.

Campbell, John P., Dunnette, Marvin D., Lawler, Edward E. III, and Welch, Karl M., Jr. Environmental variation and managerial effectiveness. In Richard M. Steers and Lyman W. Porter. Motivation and Work Behavior. New York: McGraw-Hill, 1975.

Identifies some of the conceptual difficulties involved in investigating organizational environments and their effects. Authors review the literature describing efforts to construct taxonomies of factors that affect climate and summarize the results of empirical work in this area. They attempt to synthesize previous studies with a set of four factors common to the various studies reviewed: (1) individual autonomy; (2) the degree of structure imposed; (3) reward orientation; and (4) consideration, warmth, and support. Environmental situations are described as being exceedingly complex, especially when interactions are considered. They suggest greater attention particularly to the interaction of task and climate, e.g., decentralization works

best when tasks require cooperation, and centralization works best when tasks are relatively independent. Authors also stress the importance of primacy in the initial job assignment and recommend "stretching" the individual to his capacity in the first job.

Chapman, Robert L., Biel, William C., Kennedy, John L. and Newell, A. The System Research Laboratories Air Defense Experiments. Management Science, 5 (1959), 251-269.

One of the first public reports of a series of major studies of the Air Defense System undertaken by a small group of psychologists in the early 1950s at the Rand Corporation. These studies demonstrated that under the appropriate conditions, crews learned to handle more simulated hostile aircraft than was possible without special training in the objectives of the organization, knowledge of results, and experience with tasks of increasing difficulty. Although there has been a great deal of discussion about what crews were actually "learning" in these experiments, the data reported by Chapman and his colleagues suggest that they adopted innovative methods for disregarding unimportant tracks and following only important tracks as load increased. These studies led to a world-wide training program for training radar crews in air defense and were responsible for the splitting-off from Rand of the System Development Division, which ultimately became the System Development Corporation. For an excellent summary of this and related research see Parsons, 1972.

Cherns, Albert. The principles of sociotechnical design. Human Relations, 29 (1976), 783-792.

Author sees organizational design as an outcome, not an input, generally of architects, system analysts, engineers, etc. who often have a Taylorist or Theory X bias. To survive social systems must: (1) adapt to the environment; (2) integrate people's activities; and (3) provide for continual occupation of roles. Both social and technical systems must be jointly optimized. But how? Author identifies 9 principles: (1) compatibility between design and objectives; (2) no more should be specified than what is absolutely essential, but the essential aspects must be specified; (3) variances must be controlled as close to the source as possible; (4) when the environment varies rapidly, elements should perform more than one function; (5) working groups can acquire and handle a great deal of responsibility and autonomy--the boundaries should be located so that those in position to coordinate boundaries can; (6) the system of social support should be designed to reinforce behavior which the system is designed to elicit; (7) one objective of sociotechnical design is to provide a high quality of work; (8) design is iterative; and (9) provide information in the first place where it will be used.

Coch, L. and French, J. R. P. Overcoming resistance to change. Human Relations, 1 (1948), 512-523.

Authors used group discussion to gain acceptance for changes in work methods in a garment factory. Workers showed drops in productivity when changed from one job to another that could not be accounted for by the new learning required. Control group was introduced to new jobs in traditional way: informed of the problem and the solution and invited to ask questions. Two experimental groups were given a dramatic demonstration of the problem

(competitor's garment shown), encouraged to problem solve about improving their product, and expected to arrive at some agreement about changes needed to become competitive. The control group, as expected, showed little improvement, high turnover, and was hostile to management. Both experimental groups showed dramatic improvements. For a critique, see Steele, 1973. Note that the method involved a technical component: elimination of "frills" from the garment.

Cummings, Thomas G. and Molloy, Edmond S. Improving Productivity and the Quality of Work Life. New York: Praeger Publishers, 1977.

The authors undertook this study with a grant from the National Science Foundation in an effort to assess the current state of knowledge about job satisfaction and productivity. Noting some of the limitations in the way studies were reported, the authors undertook a "hard-nosed" reevaluation of some 78 experiments reported in the literature in an effort to assess the outcomes and the "action levers" that might account for them. Action levers included: (1) pay (reward); (2) autonomy/discretion; (3) support services; (4) training; (5) organizational structure; (6) technical/physical; (7) task variety; (8) information feedback; (9) interpersonal/group processes. The 78 studies are analyzed in terms of action levers and the effect of a range of organizational changes, such as participative decision making, autonomous work groups, flexitime, Scanlon plan, etc., on costs, productivity, quality, etc. One example is included of each type of change by reprinting chapters and articles from their original sources.

Delbecq, Andre L., Van de Van, Andrew H., and Gustafson, David H. Group Techniques for Program Planning. Glenview, Illinois: Scott, Foresman and Company, 1975.

A practical down-to-earth guide to the use of several group decision making techniques. The major technique discussed is the Nominal Group Technique (NGT) which is a variant of Osborne's "brainstorming" methods but is much more controlled and orderly. NGT involves the silent generation of ideas by individuals that are then shared in round-robin fashion and discussed for clarification and prioritization. Another technique described in some detail is the Delphi, which permits problem solving and decision making without requiring that subjects be assembled in a group. Inputs are solicited, collated, and returned to individuals for comment and prioritization. Contains useful, detailed instructions for conducting Nominal Groups and using Delphi.

Fouriezos, Nicholas T., Hutt, Max L. and Guetzkow, Harold. Measurement of self-oriented needs in discussion groups. Journal of Abnormal and Social Psychology, 45 (1950), 682-690.

A distinction is drawn between motives directed at helping the group meet its goals (task directed) and the self-oriented motives of individuals in a group (ego motives) to enhance their own, personal objectives. Five basic self-oriented needs are described (Dependence, Status, Dominance, Aggression, and Catharsis) and a rating scale for each developed. Groups with the highest self-oriented scores are least satisfied with the group's functioning and outcomes. Also, groups with high self-oriented needs tended to be less

productive. Authors note the similarities and differences between their approach and Bale's interaction categories.

Frank, Linda L. and Hackman, J. Richard. A failure of job enrichment: The case of the change that wasn't. Journal of Applied Behavioral Science, 11 (1975), 413-436.

Describes an effort to shift stock transfer employees in a large bank to a semiautonomous work group thereby "enriching" the jobs of individual employees. The "innovation" failed for a number of reasons, according to the authors, the most important being that the change did not actually enrich jobs at all. The authors say that the effort was not guided by an appropriate theory--particularly workgroup theory as opposed to individual theory. They stress the importance of carefully specified target jobs before changes are made.

Freed, Alwyn M. Human interactions in man-machine systems. Human Factors, 4 (1962), 389-399.

A taxonomy of human interaction skills in organizations with some tentative suggestions for ways of defining, labeling, and measuring them. Freed defines some of the most crucial system interactions: (1) adjusting; (2) adapting; (3) alerting; (4) assisting; (5) checking; (6) coordinating; (7) communicating; (8) filtering; (9) load sharing; (10) load balancing; (11) queueing; (12) surveying; and (13) supporting. For three of these (alerting, load balancing, and checking), Freed illustrates associated activities, behaviors, and responses. Focus is on specific organizational behaviors that may be improved through design or training to increase organizational effectiveness and productivity.

French, Wendell. Organizational development objectives, assumptions, and strategies. California Management Review, 12 (Winter 1969), 23-24.

Written in non-technical language, this article introduces the reader to some of the basic objectives, assumptions, and strategies of OD. Among the basic objectives cited are to (1) increase level of trust and support among the organization members; (2) increase confrontations in the organizations; (3) change environment from authority based on role to authority based on knowledge; (4) increase communication openness; (5) increase enthusiasm; and (6) increase group responsibility for planning. Assumptions listed recognize people's desire for growth and desire to make a greater contribution to organizations. With respect to behavior in groups, OD assumes that people want to work in groups, that work groups are highly relevant to people, and people must cooperate with leaders and one another to solve problems. Numerous assumptions about people in organizations are also cited. Action research model is described as a basic OD strategy. Considerable discussion of laboratory training as one method of OD.

French, Wendell L. and Bell, Cecil H., Jr. Organization Development: Behavioral Science Interventions for Organization Improvement. Englewood Cliffs, N.J.: Prentice-Hall, 1978.

A well-known and useful text in the field of organizational development. This book is of special interest in this context because the authors focus on the organization and its renewal in their definition of OD: "Organization development is a long-range effort to improve an organization's problem-solving and renewal processes, particularly through a more effective and collaborative management of organization culture--with special emphasis on the culture of formal work teams --with the assistance of a change agent, or catalyst, and the use of the theory and technology of applied behavioral science, including action research." This definition is notable for its emphasis on problem solving and action research as vehicles for organizational renewal, which is consistent with the theme of the document that this annotated bibliography accompanies. The authors describe various intervention strategies, giving a balanced recognition to the technical side, which is sometimes overlooked or minimized in other treatments of OD.

Friedman, Charles P., Hirschi, Stanley, Parlett, Malcolm, and Taylor, Edwin F. The rise and fall of PSI in physics at MIT. American Journal of Physics, 44 (1976), 204-211.

This report is a postmortem examination of the reasons why an apparently highly successful innovation was abandoned after four semesters by the faculty of the Physics Department at MIT. Tested 5 years before its full scale adoption with small groups of students, the decision to adopt PSI (Personalized System of Instruction) and use it with hundreds of students was viewed as a highly significant event. The authors try to understand why it was abandoned despite the fact that many students were satisfied with it. They do not offer any single answer. From the faculty perspective, the method failed to teach the "ineffable" things that could be compressed into objectives, it was too mechanical, and (probably) too behavioristic. Faculty felt the program was too free and loose for their students who were trained to expect things to be tougher and more demanding. Section leaders, who were not themselves the innovators, were probably not highly motivated to use an innovation that forced them to play a passive role and underutilized their talents. Faculty also may have felt that there was little to be gained by educational research that focused on process and not on curricular matters.

Frost, Carl F., Wakeley, John H., and Ruh, Robert A. The Scanlon Plan for Organization Development: Identity, Participation, and Equity. East Lansing, Michigan: Michigan State University Press, 1974.

This book describes the Scanlon Plan as a philosophy of organization and a set of management principles. The senior author, who worked directly with Joe Scanlon before coming to Michigan State, has helped establish the plan in numerous corporations throughout the United States and has an intimate knowledge of the problems involved with its adoption and implementation. The book provides practical guidance to those interested in establishing the program in their own organizations as well as describing some of the theoretical and empirical underpinnings of the Scanlon Plan. Considerable emphasis is

placed on the readiness of an organization to become involved and the complex problem of determining the bonus to be paid to workers as a consequence of increases in productivity. From an innovation perspective, the approach may be considered as an innovation in itself, but also as a formal mechanism for generating innovations (employee suggestions).

Gardner, G. Worker's participation: A critical evaluation of Coch and French. Human Relations, 30 (1977), 1071-1078.

A critique of the widely-quoted Coch and French study of participation as a vehicle for overcoming resistance to change. The author cites numerous problems with the two experiments reported in the original article: (1) number of groups did not permit statistical comparisons; (2) groups were different sizes; (3) a dramatic demonstration was used to demonstrate the need for change to the experimental, but not the control groups; (4) group competition developed spontaneously and was uncontrolled; (5) supervision differed among groups; (6) experimental groups may have been better trained; and (7) experimental groups received knowledge of results, but control group did not.

Gilbert, Thomas F. Level and Structure of Performance Analysis: A Praxis Technical Paper, No. 1. Morristown, N.J.: Praxis Corporation, 1974.

This document describes Gilbert's approach to the observation of performance in organizations. The aim is to create a systematic performance technology that offers concrete suggestion regarding where to look in organizations in order to help them solve performance problems. Gilbert recommends that one begin with the general and move to the specific, gradually going from the organizational to the individual level. Gilbert distinguishes three levels (Policy, Strategy, and Tactics) and believes that at each level one should specify the ideal (a model) and then look for discrepancies. Those discrepancies that promise the maximum payoff are attacked first. Methods used to solve problems depend upon the performance discrepancy identified.

Gilson, Thomas Q. and Lefcowitz, Myron J. A plant-wide productivity bonus in a small factory: Study of an unsuccessful case. Industrial and Labor Relations Review, 10 (January 1957), 284-296.

Describes an unsuccessful attempt to introduce the Scanlon Plan into a small ceramic giftware firm that employs primarily women, Puerto Ricans, and "displaced persons." Management relations at the time of the test were described as "personal and autocratic." Plan was initiated without any mechanism for proposing or reviewing suggestions and the major emphasis was on the bonus only. Senior workers refused to participate on the production committee, so employees were drafted for the job. Their suggestions were really isolated complaints about working conditions rather than ideas for improving production. Although there was some improvement in productivity, the plan was abandoned. Plan failed for many reasons: lack of trust, limited understanding of the elements of the Scanlon Plan, poor communications, lack of follow-through, and lack of worker participation.

Gosling, Robert H. Another source of conservatism in groups. In W. Gordon Lawrence (ed.), Exploring Individual and Group Boundaries: A Tavistock Open System Approach. Chichester: John Wiley and Sons, 1979.

Anecdotal, but insightful, account by a group therapist of the reasons why groups resist change and the consequences. After citing the two most familiar reasons (reluctance to give up relationships and fear of the unknown), Gosling develops a third reason. Sentient groups provide an opportunity to be inconsistent, to fantasize, and engage in "what if" kinds of thinking without fear of criticism. Hence, such groups may be highly creative. They will, however, resist the tendency to make firm decisions (to change) because such decisions cut off the degrees of freedom to dream and because once a choice is made, the course is set. Three examples of working groups that permit different levels of playfulness are cited.

Gray, R. B. The Scanlon plan--a case study. British Journal of Industrial Relations, 9 (1971), 291-310.

A report of a study of the Scanlon plan at the Linwood Press Steel Company from 1963-1966. Briefly describes the plant, the program, and the underlying philosophy of the plan. The article sets out to test specifically the notion that (1) the more participative the leadership, the greater the number of suggestions; (2) restrictive practices and absenteeism are reduced under the Scanlon Plan; and (3) there are fewer grievances and disputes under the plan. Suggestion rates fall over time from $N = 386$ to $N = 41$ over 1 year period. Suggestion rates for different shop seemed to be a function of type of task, more than level of participation encouraged. (Variable is uncontrolled so it is not possible to draw conclusions about the effects of participation). Author concludes that the plan failed to cure restrictive practices, reduce absenteeism, or improve industrial relations. Evidence appears to support the idea that suggestions are correlated positively with bonus rate. No evidence presented on productivity. Quality of the human relations training appears weak. Author stresses bonus feature of the plan, not human relations training.

Greene, Charles N. The satisfaction-performance controversy. Business Horizons, 15 (1972), 31-41.

Reviews research concerning the relationship between satisfaction and performance. Greene notes the widespread belief among managers and others that satisfaction improves performance and demonstrates that the evidence does not support this assumption and in fact, "conclusively reject(s)" it. The data suggest instead that rewards contribute more to performance than satisfaction. Author draws the implications of this research for management.

Herzberg, F. Work and the Nature of Man. Cleveland: World Publishing Company, 1966.

Reports the results of 10 critical-incident studies on 17 different populations that support the dual-factor theory which suggests that man has two sets of needs, the one set based on his animal nature to avoid pain and satisfy basic

biological needs and the other for personal growth and achievement. The first set of needs are called Hygiene Needs; the second Motivators. The theory holds that motivators combined contribute more to job satisfaction than dissatisfaction, but hygiene factors contribute more to dissatisfaction than satisfaction. Subjects were requested to recall times when they felt exceptionally good about their jobs and the reasons. Subjects were also asked to recall times when they felt especially negative about their jobs. Herzberg asserts that in 97% of the cases, the results supported the dual-factor theory, i.e. satisfaction came from achievement, recognition, the work itself, responsibility, etc.; dissatisfaction resulted from company policies, supervision, work conditions, salary, status, etc. Theory and subsequent research has provided the basis for a number of efforts to enrich jobs, but has been criticized on several grounds (see House and Wigdor, 1967).

Hoffman, L. Richard. Group problem solving. In Leonard Berkowitz (ed.), Group Processes. New York: Academic Press, 1978.

Addresses the basic question: "How best can a group use the resources of its members in solving a given problem?" Skirting the issue of individual versus group problem solving, the article addresses this question by summarizing studies of group factors inhibiting and promoting problem solving. Among the factors inhibiting effective problem solving are: (1) pressures toward uniformity; (2) participation bias; (3) group structure; (4) failure to search for problems. Factors promoting problem solving are: (1) group composition; (2) group processes; and (3) acceptance. A number of difficulties surrounding research in this area are discussed.

Huse, Edgar F. Organization Development and Change. St. Paul, Minn.: West Publishing, 1975.

A book intended to be of use to both professionals and students in the area of organizational development. Written from a system perspective, the book describes the underlying assumptions and basic concepts of OD. Most of the better-known OD techniques are described in later chapters. A number of case studies are included in an appendix.

Janis, Irving L. Victims of Groupthink: A Psychological Study of Foreign Policy Decisions and Fiascos. Boston: Houghton Mifflin, 1972.

Describes a number of military operations in which the U.S. has been involved since 1941 including: (1) the Bay of Pigs; (2) the North Korean War; (3) Pearl Harbor; and (4) the Vietnam War. As a counterpoint to these unfortunate episodes in history, Janis describes two historical incidents where the outcomes were more favorable to U.S. interests: (1) the Cuban Missile Crisis; and (2) the Marshall Plan. Janis attributes many of the problems described to "groupthink" which has 8 symptoms: (1) an illusion within the group of invulnerability; (2) collective efforts to rationalize and discount warnings; (3) unquestioned belief in the group's inherent morality; (4) stereotyped views of the enemy; (5) direct pressure on any individual who deviates from the group's ideas; (6) self-censorship by individuals because of (7) a shared

illusion of unanimity; and (8) the emergence of self-appointed "mind-guards" who "protect" the group from adverse information. Janis proposes three antidotes: (1) impartial leadership; (2) encourage critical evaluation by all; and (3) appoint several groups to work on problems simultaneously.

Lewin, Kurt and Lippitt, Ronald. An experimental approach to the study of autocracy and democracy: A preliminary note. Sociometry, 1 (1938), 292-300.

Describes an experiment with two matched groups of elementary school volunteers who were invited to make theatrical masks. Masks were not made by individuals but one at a time by the group. One group worked in an authoritarian atmosphere, the other worked in a democratic atmosphere. Preliminary findings were: (1) higher tension state existed in the autocratic group; (2) greater cooperation in the democratic group; (3) more expression of constructive suggestion and better acceptance of criticism in the democratic group; (4) democratic groups produced better products and were more careful; (5) democratic groups developed a sense of community; autocratic groups developed strong sense of "going it alone"; (6) the group structure was more stable and there was more unity in the democratic group; (7) some scapegoating occurred in the autocratic group; and (8) there was a better feeling for group property in the democratic group.

Lewin, Kurt, Lippitt, Ronald, and White, Ralph K. Patterns of aggressive behavior in experimentally created "social climates." Journal of Social Psychology, 10 (1939), 271-299.

A classic study of three alternative leadership styles (democratic, autocratic, and "laissez-faire") on the behavior of four clubs of 10 year old boys. All boys worked on projects under the three different styles of leadership successively. Leaders varied within groups and leaders played different roles. Exhaustive records were taken of group structure interactions, personality, etc. Results of this experiment are mixed with an earlier study by Lippitt which the authors call the first experiment. In the earlier experiment hostility was 30 times more frequent in autocratic than in democratic groups. Aggression was 8 times as frequent. In the second experiment, only one group showed high aggression; the other groups were apathetic. Authors suggest that the apathy was a function of the repressive atmosphere since, among other things, aggression rose sharply when the leader left the room, and the boys liked the democratic and laissez-faire groups best.

Likert, Rensis. New Patterns of Management. New York: McGraw-Hill, 1961.

Early presentation of Likert's thesis that the quality of leadership is the most crucial factor in organizational performance. Supervision and leadership style, according to Likert's data, are much more important in influencing results than such general (psychological) factors as interest in the job or attitudes toward the company. Successful companies are shown to have different patterns of leadership than unsuccessful companies. Likert develops the importance of the "linking pin" function which ties work groups within an organization together and allows supervisors and subordinates to influence one

another and coordinate their activities. Four different systems of organization are described: (1) Exploitive Authoritative; (2) Benevolent Authoritative; (3) Consultative; and (4) Participative. The operating characteristics of these four types are described in some detail. Includes reviews of research supporting the theory. Point of view is not consistent with contemporary sociotechnical studies which suggest that there is no one best way of organizing for maximum efficiency (see for example Joan Woodward, 1965). Provides theoretical foundation for the Survey of Organizations.

Little, Roger W. Buddy relations and combat performance. In Morris Janowitz (ed.), The New Military: Changing Patterns of Organization, 1964.

Participant observer study of a combat rifle platoon in action during the Korean war in which the author conducted in depth interviews with individuals in order to talk about their best friends. Of 30 men interviewed, 21 designated one buddy and 5 designated 2 other persons as buddies. Certain norms governed buddy-behavior: (1) they are therapists to one another; (2) they do not state it publicly; (3) they did not boast of combat powers; (4) they do not put one another on the spot; and (5) they give each other first loyalty even over the organization by staying behind and volunteering to remain together. Buddies generally performed their roles effectively in contrast to those who did not and who ordinarily are isolates. Heroes were also sometimes isolates and found it hard to integrate into the primary group. The longer units were in the line the more their loyalties to the primary group hardened and the more likely it was that they would become deviant from the larger organization and needed a period of rest and rehabilitation during which primary group loyalties could be weakened and organizational loyalties reestablished.

Litwin, George H. and Stringer, R. The influence of organizational climate on human motivation. Paper presented at a conference on organizational climate. Ann Arbor: Foundation for Research on Human Behavior, 1966.

A study reported in Campbell, Dunnette, Lawler, and Weick (1970) that is unique because it reports the effects of organizational climate on organizational (and not just individual) behavior. Students from the Harvard Business School were divided into three competing teams that sought a contract award from a simulated government agency. Three different climates were created: (1) authoritarian-structured; (2) democratic-friendly; and (3) an achieving climate that encouraged innovation. The achieving climate produced the most in terms of dollar volume, number of new products, and cost saving innovations. The authoritarian structure produced the highest quality products. Subjects in the democratic friendly business were the most satisfied with their jobs.

Litwin, George H. and Stringer, R. A. Motivation and Organizational Climate. Boston: Harvard University Press, 1968.

The authors note that "Organization climate refers to a set of measurable properties of the work environment, perceived directly or indirectly by the people who live and work in this environment and assumed to influence their motivation and behavior" (p. 4). This means that climate may be identified

with various environmental factors that shape behavior and motivation. Authors focus considerable attention on incentives, noting that people respond not to specific expectancies and incentives, but to a more general and molar impression of their environment. McClelland's notion that the environment sets the stage for motivation to be elicited is emphasized. Thus achievement motivation, for example, is only aroused if the environment is appropriate for it and elicits it. With respect to climate, the authors emphasize that it is a generally felt variable by those involved; it is not necessarily conscious; it is cyclical, shifting, decaying, and changing from one time period to the next; and it is a molar impression made up of many factors.

Maier, Norman R. F. Screening solutions to upgrade conditions of uncertainty. Journal of Psychology, 49 (1960), 217-231.

Whenever solutions are generated by groups, they vary in quality and there are often too many of them overwhelming the group. The purpose of Maier's screening process is to reduce the number of solutions by eliminating those least apt to be successful. Two of the four screening principles described are designed to reduce the number of solutions and two are intended to help select from those they retain. (1) Acceptable solutions should be tailored to fit particular problems. Therefore solutions transferred from other problems should be rejected; (2) Solutions supported by facts or interpretations of facts that are challenged by other members of the group should be rejected; (3) Solutions that are supported by unchallenged facts should be selected and evaluated; and (4) When exceptions to a trend can be explained, solutions based on the trend should be selected for evaluation. Solutions selected should be evaluated in terms of cost and practical considerations, acceptability to the group, the extent to which they are supported by the facts, and the way the alternative solutions may be combined.

Maier, Norman R. F. Problem-solving Discussions and Conferences: Leadership Methods and Skills. New York: McGraw-Hill, 1963.

This book is directed primarily at improving the leadership of discussion groups. Maier begins by making the point that effective decisions have two aspects: (1) their quality, and (2) their acceptability. These two factors multiply together to determine the effectiveness of a decision. The extent to which the decision must be of a high quality or acceptable to others determines the degree to which the organization's member must be involved in making it. In this sense, Maier sets the stage for Vroom and Yetton's later theoretical formulations. Maier emphasizes the importance of presenting well-stated issues that do not include an implicit solution and that insure the clarification of problems before the group attempts to arrive at solutions. Contains a very useful description of a method known as problem posting, which is a modified form of "brainstorming."

Maier, Norman R. F. and Solem, Allen R. Improving solutions by turning choice situations into problems. Personnel Psychology, 15 (1962), 151-157.

An empirical study demonstrating Maier's repeated assertion in the literature that groups have a natural tendency to leap to solutions and that problem

solving can be improved when groups are encouraged to be "problem-minded," rather than "solution-minded." Using the Change of Work Procedures case, which has three basic solutions, 264 students and 320 supervisors were divided into 146 problem solving, role playing, groups of 4 people each. Experimental groups were given instructions designed to make "them view the situation more as a problem to solve than as a decision to make." Experimental subjects produced more than three times as many high quality solutions.

Mausner, Bernard. The effect of one partner's success in a relevant task on the interaction of observer pairs. Journal of Abnormal and Social Psychology, 49 (1954), 557-560.

This study demonstrates that Ss will have a greater tendency to accept the judgment of their partners when the partners have previously demonstrated success on the task. Subjects were 28 psychology students paired with a confederate of the experimenter who was told to fail with some subjects (N = 11) and succeed with others (N = 17). Ss observed and recorded their partner's score, who judged the lengths of a number of lines alone. Subjects then performed the same task together, one following the other for each presentation. Ss who worked with previously successful partners tended to converge on their judgments. Author suggests that observed prior success or failures may be an antecedent condition to "prestige."

McGregor, Douglas. The Human Side of Enterprise. New York: McGraw-Hill, 1960.

In this book, McGregor develops the basic assumptions that guide traditional approaches to management and control (Theory X), and those suggested by research in the social sciences (Theory Y). Theory X assumes that the average person (1) dislikes work; (2) must be coerced, directed, threatened, etc.; (3) wishes to avoid responsibility; and (4) is controlled primarily by money. Theory Y, in contrast, assumes that (1) work is natural; (2) men will work for many objectives to which they are committed and do not need to be controlled by threats; (3) people are committed to something when they find it rewarding; (4) the average person can learn to accept and seek responsibility; (5) most people are capable of creative problem solving; and (6) people are in general underutilized. Discusses a variety of ways of integrating people into their work including participation and the Scanlon Plan.

Miller, Eric J. Open systems revisited: A proposition about development and change. In W. Gordon Lawrence (ed.), Exploring Individual and Organizational Boundaries: A Tavistock Open System Approach. Chichester: John Wiley and Sons, 1979.

A non-quantitative case study of agricultural development in Mexico in which the author tries to illustrate the importance of changing the environment if innovations are to be sustained. The author describes four models of development: (1) top-down; (2) bottom-down; (3) enlightened paternalism; and (4) a negotiative model. He endorses the fourth as the only viable model, but it implies a true sharing of power. "The primary task of a development

programmer is to help the client system to increase its control of its environment." (p. 227) Drawing the implications for OD, Miller believes the client systems, also, have to change their environments if change is to be sustained and that consultants (whether OD consultants or psychotherapists) are implicated in the resulting power struggle.

Miller, Eric J. and Rice, Albert K. Systems of Organizations: The Control of Task and Sentient Boundaries. London: Tavistock Publications, 1967.

The authors draw an important and useful distinction between task and sentient groups which is basic to their open systems framework for understanding organizations. The primary task of organizations is to perform those activities that are essential to their survival, and that is the objective of the task group. The sentient group demands or receives loyalty from its members--they are groups to which individuals are loyal and committed. The authors make the point that the two groups may not coincide and discrepancies between them are inevitable. Numerous examples are discussed of the different degrees of overlap in a family owned business, for example, or traditional industries. The authors believe that task systems that are temporary and transitional are more common and general than stable task systems. Sentient groups, therefore, often lie outside of the task group, particularly in these temporary systems. From this point of view of innovation, sentience provides a high level of satisfaction with the status quo and may inhibit change. "To remain adaptive, the greatest sentience must remain in a group committed to change" (p. 260)--not in those who resist and from whom sentience may have to be withdrawn. Authors stress that task and sentient system boundaries must be clearly defined and controlled.

Miller, James C. The psychology of innovation in an industrial setting. In W. Gordon Lawrence (ed.), Exploring Individual and Organizational Boundaries: A Tavistock Open System Approach. Chichester: John Wiley and Sons, 1979.

A non-quantitative case study of a small plant built in New York about 15 years ago that has managed to achieve a high level of morale and productivity by creating a "family" atmosphere that encourages innovation at all levels. Workers serve on production teams, are rotated among jobs, encouraged to be involved in decision making, are not required to punch timeclocks, etc. Management encourages personal growth. The authors believes that the commitment of employees can be explained by their attachment to "Utopian fantasies" about the plant that are gradually being displaced as the physical plant and employees grow older. Difficulties in the plant today are more intractable than in the past because all of the easily solved problems have been solved and can no longer be attributed to growing pains. There is, also, less upward mobility as people settle into positions. In brief, the "Utopian fantasies" are disappearing.

Moore, Nancy C. and Reimer, Everett. The experimental change of a major organizational variable. Journal of Abnormal and Social Psychology, 52 (1956), 120-129

This field experiment was conducted in one department of a nonunionized plant to test two hypotheses that increased role in decision making would lead to

increased (1) satisfaction and (2) productivity. Four parallel divisions were compared, two were made more autonomous and two somewhat less autonomous. Autonomous divisions did make decisions about many things including work processes and methods, personnel matters, etc. Individual satisfactions increased significantly in the autonomous divisions and decreased in the hierarchical divisions. Both divisions showed some increased productivity, but it was greatest in the hierarchical divisions. Since productivity was affected by other departments, the only direct control which these groups had over productivity came by reducing staff which autonomous groups were reluctant to do.

Oakes, William F., Droge, Arnold E., and August, Barbara. Reinforcement effects on participation in group discussion. Psychological Reports, 7 (1960), 503-514.

Subjects in this study were either positively reinforced for their verbal comments to psychiatric case histories or punished. The reinforcement was administered by a flashing light that indicated their statements showed "psychological insight" or "a lack of psychological insight." A strong statistically significant differential effect was demonstrated. Positively reinforced subjects became very verbal and sometimes talked compulsively. Punished subjects grew silent. Positively reinforced subjects seemed to enjoy the experiments; punished subjects became dejected and left the room with relief.

Organizational Dynamics. At Emory Air Freight positive reinforcement boosts productivity. Organizational Dynamics (Winter 1973), 41-50.

An enthusiastic, but largely unsystematic and non-quantitative study of the effects of positive reinforcement on performance. Data collected suggests substantial improvements in productivity, but the changes seem to involve motivating employees to utilize (and perhaps generate) innovations. For example, the authors point with pride to a savings of \$650,000 made possible by the simple innovation of combining small shipments in a single container. The problem was to motivate employees to follow the procedure which positive reinforcement did. Also, there is some suggestion that employees were encouraged to problem solve.

Osborn, Alexander F. Applied Imagination: Principles and Procedures of Creative Thinking. New York: Scribner, 1957.

A text in the area of applied creative thinking that gained a fairly large audience. Written in a simple, easy to read style, the message of the book is that everyone can be helped to make a creative contribution if the blocks to creativity are removed. As the title implies, the book tries to provide the reader with active practice applying the imagination. Of particular interest are the chapters on group problem solving and the early efforts to develop "brainstorming" methods. The author provides some data on the stimulation of ideas by brainstorming and tries to explain it. The four basic rules of brainstorming are: (1) criticism is ruled out; (2) free-wheeling is welcomed; (3) quantity (number of ideas) is wanted; and (4) elaborations on the ideas of others and combinations of ideas are encouraged. The author

also provides suggestions for posting and screening ideas and devising questions that stimulate creativity. Subsequent research suggests that brainstorming is effective in producing more ideas but the quality is unsettled (see Hoffman, 1978).

Parsons, Henry McI. Man Machine System Experiments. Baltimore: The Johns Hopkins Press, 1972.

Major survey of government sponsored research, usually conducted for the military, that is seldom referenced in professional, academic journals. Many of the studies described by the author were originally classified and consequently not available to the general public. To collect the information for this comprehensive report, the author visited a number of laboratories and consulted with many authorities who have worked in the field of man-machine systems. After reporting the results of a number of projects, Parsons draws some implications from this extensive body of research.

Shils, Edward A. and Janowitz, Morris. Cohesion and disintegration in the Wehrmacht in World War II. Public Opinion Quarterly, 12 (1948), 280-315.

Based on an extensive series of interviews with German POW's and re-captured allied personnel, the reports of combat observers, and captured documents, the authors conclude that the unity of the German army was sustained largely by the satisfaction of soldiers with their primary groups and had little to do with political convictions. Secondary symbols, e.g., unit insignia, were important only to the extent that they were associated with primary satisfactions. When primary groups were destroyed, there was little or no last ditch resistance. Among army groups with a high degree of primary group integrity, there were few desertions. Deserters tended to be members of heterogeneous ethnic units, other unassimilated elements, and men with difficulties adjusting to group life. Propaganda directed at secondary symbols was largely unsuccessful. When resistance began to disintegrate toward the end of the war, the single most effective leaflet was one with little "propaganda" but a simple, official message assuring personal survival and safe conduct. Factors that were found to weaken primary group solidarity were: (1) isolation of individuals; (2) symbols of home and family (reestablishing the old primary group ties); (3) demand for physical survival.

Siegel, Saul M. and Krenmerer, W. F. Measuring the perceived support for innovation in organizations. Journal of Applied Psychology, 63 (1978), 5, 533-562.

Defining an innovative organization as "one that fosters creative functioning of its members," the authors developed a scale to measure climate that included three factors: (1) support of creativity, (2) tolerance of differences, and (3) personal commitment. They then attempted to validate the scale in public schools that were judged to be innovative or traditional (not oriented to foster creativity). The scale was administered to 1,899 students and teachers in these two types of institutions. Two factors seemed to differentiate among the two types: (1) support of creativity; and (2) tolerance of differences.

Snow, Charles Percy. Science and Government. Cambridge, Mass.: Harvard University, 1960.

Recounts the bitter rivalry between Sir Henry Tizard and F. A. Lindeman (Lord Cherwell) over the adoption and development of one invention (radar) and an innovation (strategic bombing). Each man was tied to a different political party and their ideas were inevitably shaped by political events. Snow clearly feels that Tizard was right in his support of radar and opposition to strategic bombing, and that Lindeman was wrong. He shows how personal animosity may interfere with the objective assessment of innovations. But, Snow is particularly concerned with the climate of secrecy that surrounds these decisions and the concentration of power in Lindeman's hands under Churchill. He recommends that decisions of this kind be subject to broader review and warns against giving "gadgeteers" the power to implement their own pet ideas. A powerful argument against closed politics and in favor of open, informed, scientific inquiry.

Solem, Allen R. An evaluation of two attitudinal approaches to delegation. Journal of Applied Psychology, 42 (1958), 36-39.

A role-playing study designed to determine how the set provided to the group by the leader affects the outcome. Leaders who were selected at random, were told either to: (1) arrive at a decision and discuss it with the group; or (2) present a problem to the group and accept the solution. Delegating the problem to the group (#2 above) yielded better results on the whole in terms of acceptance, quality, and satisfaction. Subjects were 456 supervisors attending a conference.

Steiner, Ivan D. Group Process and Productivity. New York: Academic Press, 1972.

A look at task groups and the factors that influence their productivity in the performance of different types of tasks. Productivity is declared to be a function of three variables: (1) Task demands, (2) Resources, and (3) Processes. Actual productivity is potential productivity (as determined largely by resources available minus "losses due to faulty process"). The author distinguishes between different types of tasks: (1) divisible versus unitary tasks; (2) maximizing versus optimizing tasks; and (3) permitted processes: disjunctive, conjunctive, additive, and discretionary. Numerous variables that affect productivity in these different types of groups are then discussed, including group size, composition, and motivation. Contains useful taxonomy. Overlooks the role of innovation in productivity by assuming that potential productivity is largely a matter of the resources available and conformity to appropriate task process descriptions.

Whitehead, Alfred N. Science and the Modern World. New York: The Macmillan Company, 1925.

In this book Whitehead traces the development of science from the earliest times down to the present (1925). He develops a number of ideas which are important features of his philosophical position, the most notable being that

process is the ultimate reality, not matter. Simultaneously he describes two basic assumptions that run through Western thought: the idea of simple location and the fallacy of misplaced concreteness. Among the propositions developed is the idea that Western science is an act of faith in the lawfulness of the universe. This idea of a lawful universe, in turn, is based on Judaeo-Christian teachings.